

AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

# ELECTRONICS

## AUSTRALIA

JULY 1984 AUST \$2.30 NZ \$2.75

**Build an antique  
shortwave radio**

**We review the  
new Marantz CD player**

**Make your VIC-20 talk**

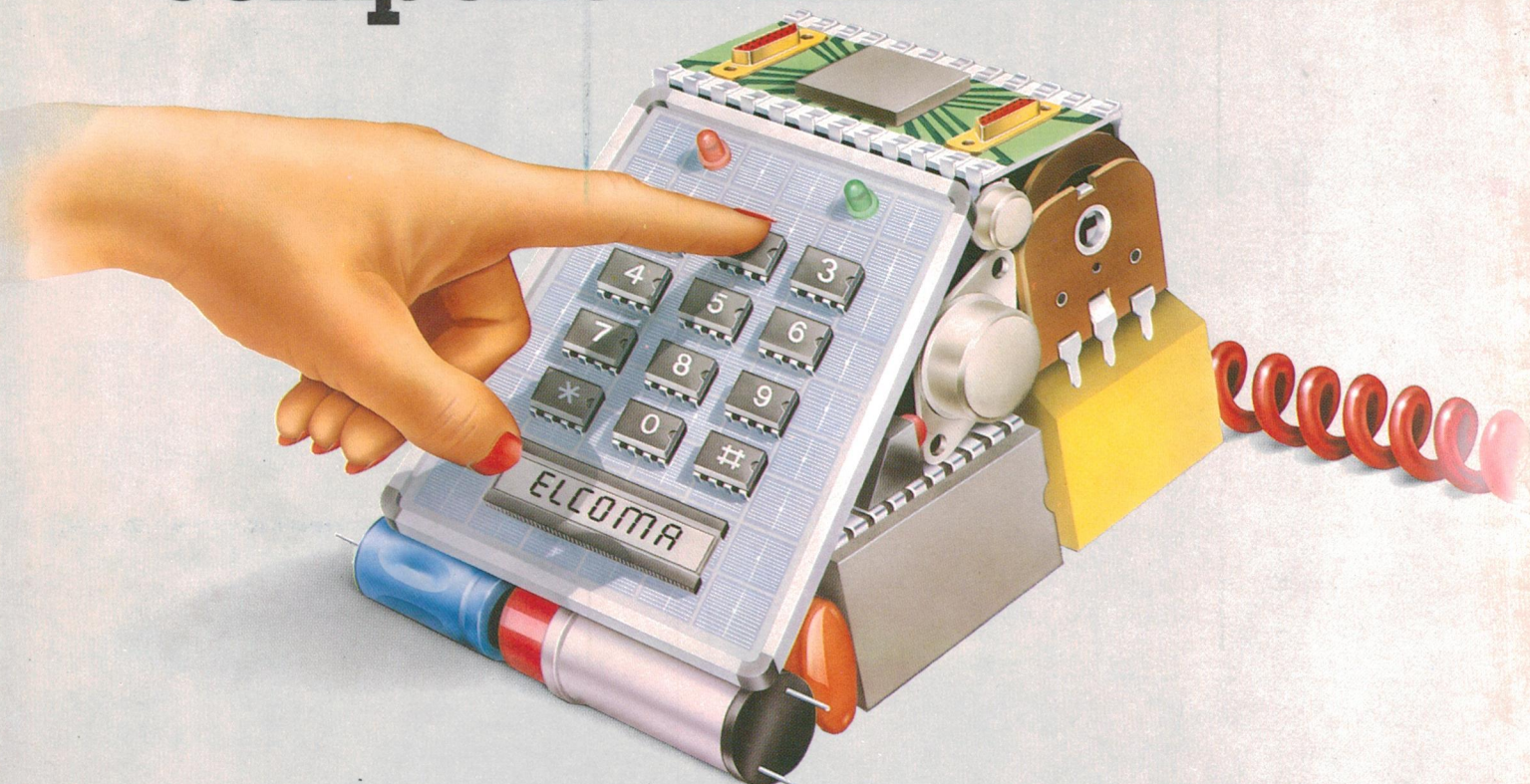
**All about  
INTERSCAN**



**WIN AN  
AIRCRAFT**  
DETAILS  
INSIDE



# Phone for telecommunications component innovations



Telecommunication equipment manufacturers face constant pressure for more and more user features. These pressures are accompanied by complex technical problems imposed by the highly sophisticated integration of business communications and information systems.

"New" equipment frequently becomes obsolescent, virtually from the first production run.

Elegant technical solutions, design flexibility and inherent reliability stem from the very latest "chip" and component technologies. So the long-term winners will be the companies who employ the most up-to-date and reliable electronic technology right from the start – moving their new designs smoothly into production.

This is where Elcoma fits in. It is precisely the

area in which we shine – innovation and reliability.

Our research laboratories in the UK, West Germany, France, Holland, Belgium and the USA are long established and internationally acclaimed centres of fundamental research.

Considering that our catalogues contain 200,000 products for all branches of the electronics industry – and our turnover, globally, exceeds our nearest competitor by over 50% – it is highly likely that Elcoma are already efficient suppliers to your needs.

If not, why not use your telephone to take advantage of our experience?

Sydney	<b>427 0888</b>	Melbourne	<b>542 3333</b>
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Brisbane	<b>44 0191</b>		

*We make electronics in Australia*



**Electronic  
Components &  
Materials**

# PHILIPS



AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

# ELECTRONICS AUSTRALIA

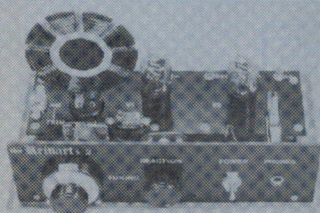
Volume 46, No. 7, July 1984



## On the cover

Styled after the 1930's era, this beautifully presented shortwave receiver uses two RAF-type valves and plug-in spiderweb coils. It covers the medium and shortwave bands to 19MHz (see page 52).

## Vintage 1930s shortwave receiver



Listen to the world with this working model vintage shortwave receiver. Using 1930s triode valves and spiderweb coils, it will bring back the excitement of the "good old days". Construction starts on page 52.

## What's coming

You don't have to trade in your current TV set to receive teletext. Next month, we intend to describe a teletext decoder which, when mated with your VCR, will provide the full range of teletext functions (see also page 131).

## Build these heat controllers



Keeping warm in winter without sending the power bill soaring is a real problem. These heat controllers will help save your dollars (see page 76).

## Features

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## Win this ultralight aircraft

Win an aircraft: This Javelin ultralight aircraft, valued at \$8775, is the first prize in a competition being conducted by Dick Smith Electronics. Full details will be found in the Dick Smith mailer enclosed with this issue.



**STOP PRESS! STOP PRESS!**  
2 year Contract as official supplier  
to NSW Gov't for Kikusui, COS 5020  
(Contract No. 84/7529)  
**STOP PRESS! STOP PRESS! STOP PRESS!**

**\$469\***

**UNBEATABLE  
VALUE FOR A**

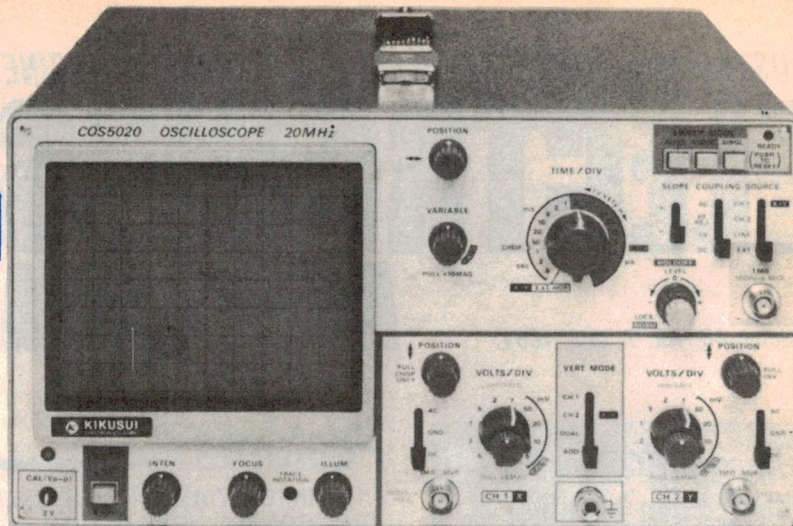


## COS-5020

**20 MHz 2-channel**

Sensitivity: 5mV/div — 5V/div;  
1mV/div at x5 MAG.  
Bandwidth: DC or 10 Hz — 20 MHz.  
Sweep Mode: AUTO, NORM, SINGLE.  
Trigger Source: CH1, CH2, LINE, EXT.  
X-Y Operation, CHOP and TV.  
Dust Cover: optional

**INCLUDING TWO  
(1:1/1:10) PROBES!**



**meguro**

## MO-1251

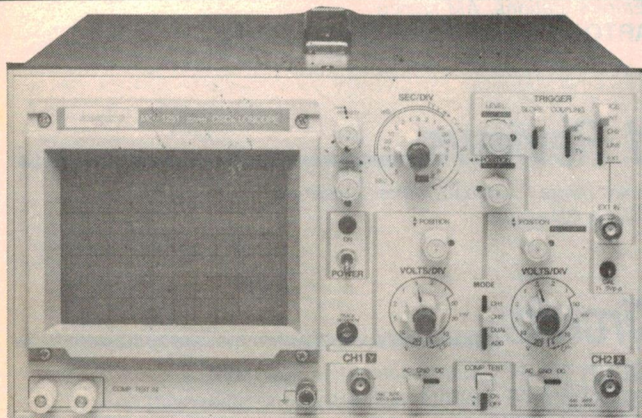
**20 MHz 2-channel**

with component tester

Sensitivity: 5mV/div — 20V/div; 1mV/div at x5 MAG  
Bandwidth: DC or 10 Hz — 20 MHz.  
Sweep Mode: NORMAL, AUTO.  
Trigger Source: INT, CH2, LINE, EXT.  
X-Y Operation; & Z-Axis modulation  
Component Tester: for R, L, C & diodes.  
Dust Cover: optional

**\$525\***

**INCLUDING TWO (1:1/1:10) PROBES!**



**meguro**

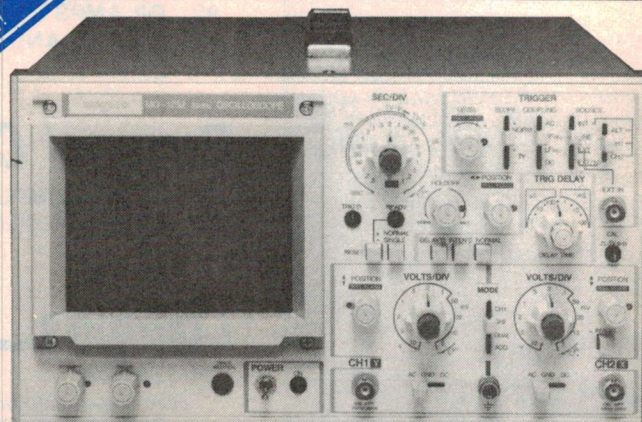
**INCLUDING  
TWO (1:1/1:10)  
PROBES!**

## MO-1252

**35 MHz 2-channel**

Sensitivity: 5mV/div — 10V/div; 1mV/div at x5 MAG.  
Bandwidth: DC or 10 Hz — 35 MHz  
Sweep Mode: NORMAL, AUTO, SINGLE, DELAY.  
Trigger Delay: INTEN'D, DELAY'D; 1μs — 100 ms.  
Trigger Source: INT, LINE, EXT, EXT/10.  
X-Y Operation; & X-Axis modulation.  
Dust Cover: optional

**\$749\***

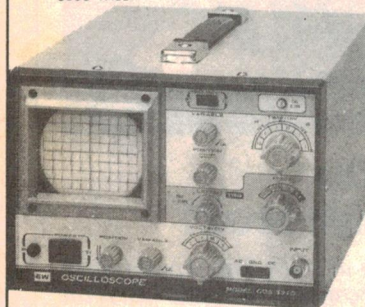


## GOS-3310

**COMPACT TRIGGERING CRO  
10 MHz 1-channel, 75 mm CRT**  
**GOS-3310 Specifications**

Sensitivity: 5mV/div — 5V/div.  
Bandwidth: DC or 2 Hz — 10 MHz.  
Trigger Mode: AUTO, NORM, EXT,  
TV.  
Trigger Source: INT, EXT.  
X-Y Operation.  
CRT: 75 mm.

**\$299 \***



## GOS-955

**GOOD WILL THE POPULAR GOS-955  
5 MHz 1-channel, 130 mm CRT**  
**GOS-955 Specifications**

Sensitivity: 10mV/div — 1V/div  
(with attenuator).  
Bandwidth: DC or 2 Hz — 5 MHz.  
Sweep Frequency: 10 Hz — 100 kHz.  
Synchronisation: INT + or -, LINE, EXT.  
CRT: 130 mm.

**\$269 \***



**EMONA INSTRUMENTS**

Division of  
EMONA ENTERPRISES PTY LTD

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**QLD** Baiter Systems Pty Ltd, Brisbane, Phone 369 5900  
Solex Electronic Sales & Service, Townsville, Phone 72 2015  
\*Add 20% sales tax if applicable

**VIC** Radio Parts Group, Melbourne,  
Phone 329 7888  
**WA** Hanco Engineering Pty Ltd, Perth,  
Phone 381 4477  
**SA** Int's Communication Systems Pty Ltd,  
Port Adelaide, Phone 47 3688

**TAS** George Harvey Electronics, Hobart,  
Phone 34 2233  
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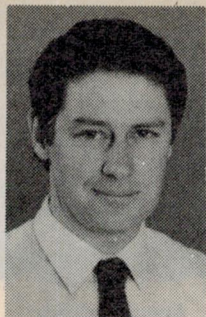
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## Editorial Viewpoint

### A fine program on the ABC

No doubt many viewers will have enjoyed the very fine documentary series "Out of the Fiery Furnace" which has been running on the ABC lately. This Australian program has been very well researched, put together and narrated by one of the best ever commentators — Michael Charlton.

What a joy it is to watch this program. It is in such stark contrast to the ABC's current affairs programs "Four Corners" and "Nationwide".

Nationwide in particular has degenerated into a TV version of the afternoon newspaper with trivialised stories introduced in breathless excitement by Geraldine Doogue, the whole lot further spoilt by abysmally poor production. How Maximilian Walsh got tangled up in this lot must be a story in itself. Several recent episodes of Nationwide (for it is more like a soap opera) have featured Geraldine Doogue talking on the telephone to some far-flung reporter in Upper Mudgudgeonland. Gripping TV indeed.

The point is that the ABC has demonstrated, with such programs as "Out of the Fiery Furnace", "Countrywide" and even, dare I say it, "Rock Arena", that it has the wherewithal and ability to put entertaining and informative programs to air. Let us fervently hope that their current reorganisation leads to a stronger and more viable broadcasting system. As I have stated in the past, the ABC is our National network. We should be able to feel justly proud of it. Come on ABC. Pull your socks up.

### VHS has won the battle against Beta

The writing is on the wall for Beta format video machines. You have probably noticed big department stores running specials on Beta VCRs at prices under \$400. No announcements have been made but it is the beginning of the end for the Beta format. For some time now the VHS format has had the lion's share of sales and this has been recognised by video rental shops who are now concentrating on stocking VHS to the detriment of Beta format movies.

At the same time, sales of blank tapes have been running solidly in favour of the VHS format. No doubt this has partly been because of greater demand from the duplicating houses for VHS stock for rentals. The trend has become so marked that when BASF recently released their new premium grade 4-hour video tape they did not bother to release a version for the Beta market. They reckon it's not worth it.

Even Sony, the chief proponent of the Beta format, has recognised the trend and is marketing VHS blank tape. How much longer will they continue to sell Beta VCRs?

None of this means that Beta VCRs are inferior to VHS machines. In fact, it is probably the other way around with Beta machines giving a slightly better picture and generally, more features for a given price. But, for a number of reasons, mainly related to the marketing of VCRs, VHS has won the sales battle. It remains for the Beta manufacturers to declare that they are defeated.

**Leo Simpson**

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# It's AVTEK's Birthday

## The Multi Modem The Finest Modem in its Class

Now you can afford a modem with all the features. By using the just released LSI 'World Modem' chip we are able to offer the performance you would normally only get with modems costing 3-4 times the price. The Avtek Multimodem is designed in

Australia to suit both the Australian and International standards. Working at both 300 and 1200 baud, it provides all the currently available protocols, whether you wish to communicate down the road or across the world.

### Kit Form

Ideal for private line use and Amateur Radio operators for Packet Radio. This kit is complete to the last nut and bolt and includes pre-punched and silk screened front and back panel.

**only \$249<sup>00</sup>**

### Free Pack and Post this month only

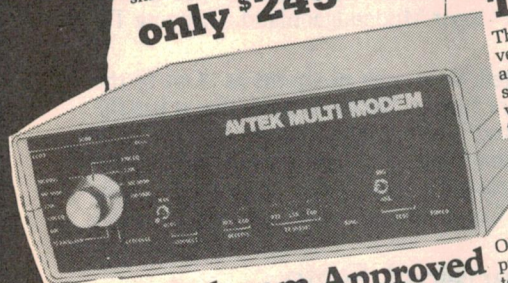
### Fully Built and Tested

The fully assembled and tested version can be legally plugged into any phone socket to replace your standard phone. It comes complete with a telephone hardwired into the modem.

**only \$329<sup>00</sup>**

### Custom

OEMs please enquire - we can probably build you a 'custom' unit to your exact requirements for a fraction of the price you would expect to pay.



**Fully Telecom Approved**

### Specifications:

**Data Standards:** CCITT V.21 & V.23, Bell 103 & 202  
**Data Rates:** 300, 600 and 1200BPS  
**Backward Channel:** 75 PBS in conjunction with 1200 BPS  
**Computer Interface:** CCITT V.24 (RS232C)  
**Power:** 240VAC/3W  
**Front Panel Controls:** Mode switch (12 position rotary), Connect Switch (3 position toggle), Tests Switch (3 position toggle).

**Front Panel Indications:** Connect LED, Data Carrier Detect, Received Data, Request to send, Clear to send, Transmit Data, Ring Detect, Test switch off normal, POWER.

### Save over 40% on Regulators

7805, 12, 15 positive voltage regulators  
Normally \$1.20, this month:

**only 75¢**

7905, 12, 15 negative voltage regulators  
Normally \$1.50, this month:

**only 85¢**

## Thermistor Bargain

Philips type 56R 2232-660-91009. Refer Philips catalogue for specs. Thousands of uses. Going at a giveaway price.

**\$1<sup>00</sup> for 25!!**

## Robotics Motor

**Back in Stock  
by Public Demand**

Perfect to drive your automated helper around.

Nominally 24 volt, but runs perfectly on 12VDC. These motors put out incredible torque - try and stall one!

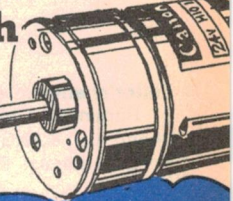
- ★ Output speed at 12V no load approx 100mA
- ★ Stalled current approx 200mA
- ★ Size overall 55mm long by 35mm wide
- ★ Shaft length 20mm
- ★ Shaft diameter 4mm

These superb motors are made by Canon We are selling them at approximately 30% of the normal price.

**\$9<sup>99</sup> each**

**\$31<sup>00</sup>**

**for 4.**



## Neutrik Connectors - the Best for Less

Replacing the standard 'Cannon' connectors, Neutrik connectors offer a higher standard of performance together with a number of revolutionary features, making them right choice where you need the ultimate in reliability and ease of use.

A revolutionary collet type cable grip provides a reliable grip on both thick and thin cables and a touch lock device allows you to quickly and easily remove and insert the cables. Construction is to the highest standard - made in Switzerland!

### Prices:

**3 pin 1-9**

Line Male 3.50

Line Female 3.50

Chassis Male 3.20

Chassis 3.50

Female

Chassis Male 2.50

non locking

Chassis Female non locking 2.50

Line Male 4.95  
right angle  
Line Female 4.95  
right angle

### 4 pin

Line Male 4.50

Line Female 5.50

Chassis Male 3.50

Chassis 3.50

Female

### 5 pin

Line Male 6.50

Line Female 7.50

Chassis Male 5.50

Chassis 5.50

Female

### 6 pin

Line Male 8.95

Line Female 10.95

Chassis Male 7.50

Chassis 7.50

Female

### Mains Type

Line Male 6.50

Line Female 6.50

Chassis Male 6.50

Chassis 6.50

Female

**10up (any mix)  
Deduct 10%**

## Huge saving on T05 Heatsinks

Others are selling these black anodized aluminium heatsinks for 95¢ each! Look at our tiny price:

**\$1.50**

**for 10!!**

## Best Prices on Gel Cells

We've bought a large shipment of US made Technacell brand Gel Cells. These maintenance free rechargeable batteries are ideal for cyclic and standby use. They may be placed in any position.

### 6V/4AH

Available in quick disconnect spade terminals or spring terminals. Weight 2lbs. Max discharge current 60A (spade terminal type).

The spring terminal model has a built in circuit breaker to protect against short circuit.

Size: 108(H) x 67 x 67mm

**Normally \$17.95**

**only \$16<sup>15</sup>**

## 2500uF/35V Electro

These super useful capacitors include bracket. They normally sell for over 50¢ each. **\$2.00 each.**

**2661-3 USARTS only going for a song \$14<sup>95</sup>**

Worth over \$25.00 each. Look at our incredible price.

### 6V/8AH

Spade terminals. Size 140(H) x 110 x 66mm

**normally \$22.95**

**only \$20<sup>65</sup>**

### 12V/4.0AH

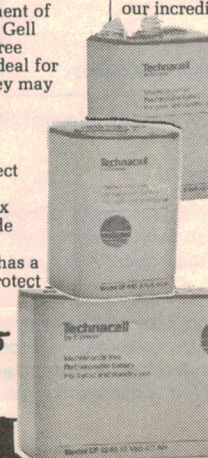
Spade terminals. Weight 4.06lbs. Maximum discharge 60A.

Terminals may be used as solder lugs.

Size: 96(H) x 130 x 67mm

**Normally \$25.95**

**only \$23<sup>35</sup>**





# Sale!!

## D Connectors - Massive Birthday Savings

Our prices on top quality D connectors are the lowest around but for our birthday special we have reduced them a further 20%. Work out the price from the list below then deduct 20%. For this month only!!!

### 'D' Connectors Solder Type

	1-9	10up
DE9S Male 9 pin	2.50	2.20
DE9S Female 9 pin	2.95	2.70
DE9 Backshell 1 piece	2.00	1.80
DE9 Backshell 2 piece	2.95	2.50
DA15P Male 15 pin	2.95	2.50
DA15S Female 15 pin	3.50	3.00
DA15 Backshell 1 piece	2.00	1.80
DA15 Backshell 2 piece	2.95	2.50
DB25P Male 25 way	4.50	3.95
DB25S Female 25 way	4.95	4.30
DB25 Backshell 1 piece	2.00	1.80
DB25 Backshell 2 piece	2.95	2.50

20%  
OFF  
THESE  
PRICES!

10%  
OFF  
THESE  
PRICES!

### 'D' Connectors PC Mount

	1-9	10up
Male 9 pin PCB Mnt	3.25	3.10
Female 9 pin PCB Mnt	3.95	3.75
Male 15 pin PCB Mnt	3.95	3.75
Female 15 pin PCB Mnt	4.95	4.60
Male 25 pin PCB Mnt	4.50	4.10
Female 25 pin PCB Mnt	5.50	5.00

## IDC Connectors Biggest Range, Best Prices!!

Avtek have really cornered the market on these connectors. IDC (Insulation Displacement Connectors) are the best, quickest and most reliable way to connect electronic equipment. We have a huge range of IDC connectors and matching cable, all ready for immediate delivery!!!

### IDC Connectors P.C. Mount Headers

	1-9	10up
10 pin Straight Header	3.75	3.50
16 pin Straight Header	4.75	4.50
20 pin Straight Header	5.50	5.00
26 pin Straight Header	6.75	6.00
34 pin Straight Header	7.75	7.00
40 pin Straight Header	8.75	8.00
50 pin Straight Header	9.75	9.00

	1-9	10up
10 pin Right Angle Header	3.75	3.50
16 pin Right Angle Header	4.75	4.50
20 pin Right Angle Header	5.50	5.00
26 pin Right Angle Header	6.75	6.00
34 pin Right Angle Header	7.75	7.00
40 pin Right Angle Header	8.75	8.00
50 pin Right Angle Header	9.75	9.00

### Wire Wrap Headers

	1-9	10up
34 Pin Right Angle	7.95	7.00
50 Pin Right Angle	12.95	11.95



### Card Edge Connectors

	1-9	10up
10 pin Card Edge Connector	7.95	7.00
16 pin Card Edge Connector	8.50	7.95
20 pin Card Edge Connector	8.50	7.95
26 pin Card Edge Connector	8.95	8.50
34 pin Card Edge Connector	7.95	7.50
40 pin Card Edge Connector	11.50	11.00
50 pin Card Edge Connector	12.00	11.50

### Female Socket Transition Connectors IDC Type

	1-9	10up
10 pin socket	4.50	4.00
14 pin socket	5.00	4.50
16 pin socket	5.25	4.50
20 pin socket	5.50	5.00
24 pin socket	6.00	5.50
26 pin socket	6.50	6.00
34 pin socket	7.50	7.00
36 pin socket	7.95	7.50
40 pin socket	8.50	7.95
50 pin socket	9.95	8.75

### IDC DIP Plugs

	1-9	10up
8 pin plug	2.95	2.50
14 pin plug	1.95	1.50
16 pin plug	2.25	2.00
18 pin plug	3.95	3.20
20 pin plug	3.95	3.20
22 pin plug	3.95	3.20
24 pin plug	3.95	3.20
40 pin plug	6.50	5.95

### IDC Centronics Connectors

	1-9	10up
24 pin Male	14.95	14.00
24 pin Female	14.95	14.00
36 pin Male	15.95	15.00
36 pin Female	15.95	15.00
50 pin Male	17.95	17.00
50 pin Female	17.95	17.00

### 'D' Connectors IDC Type

	1-9	10up
9 pin Male	8.50	8.00
9 pin Female	8.95	8.50
15 pin Male	9.95	9.00
15 pin Female	10.95	10.00
25 pin Male	11.95	11.00
25 pin Female	12.95	12.00
37 pin Male	15.95	15.00
37 pin Female	16.95	16.00
50 pin Male	20.95	19.95
50 pin Female	22.95	21.95

### IDC Cables

#### Grey Colour

Price per metre	16 way	\$2.20
10 way	\$1.25	25 way \$3.95
16 way	\$1.75	34 way \$4.95
26 way	\$2.50	
34 way	\$3.45	
50 way	\$5.25	
60 way	\$6.25	

#### Twisted Type (Low Noise)

26 way	\$5.95
--------	--------

# Get in for Your Cut!!

## Book Bargains

### Motorola M6800 Programming Reference Manual

Includes description of M6800 Program visible registers, Interrupts and Stack operations, Address Modes, Instruction set, Commands for EXbug, MIKbug, MINibug II, MINibug III. Also has descriptions of MPU, ROM, RAM, PIA and ACIA. Normally selling for \$9.95

**only \$3.95**

### Motorola Linear Interfacing Manual

Includes full technical details of the huge range of Linear ICs including: Memory/ Microprocessor Support, Driver Receivers, Communication Interface, Voltage Comparators, Data Conversion, Voltage References. Cross referenced with package information and applications notes. A must for every professional or hobbyist.

Normally selling for \$11.95. This month:

**only \$4.95**

### The Joys of Minis and Micros

A collection of articles from 'Computer Decisions' covering the use of the small computer for business. Cuts through the advertising hype to enable the business man to make the right decisions.

Normally \$14.95  
**now only \$4.95**



### PASCAL with Style

'Programmers can write programs that work first time.' This is the theme of this valuable text. Samples of programs used to illustrate the point.

Normally selling for \$14.95

**only \$4.95**

### BASIC with Style

Intended for BASIC programmers who want to write carefully constructed, readable programmes. Rules for writing more accurate, error free programs. An excellent guide to program design and efficiency. Normally selling for 14.95

**only \$4.95**

### Using Microcomputers in Business

Written by a consultant to owners of small businesses, this book is essential reading for any purchaser of microcomputer systems or software.

Normally \$14.95  
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## The Electro-optical Components Data

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# News Highlights



## RCA discontinues CED videodisc player — writes off \$100 million

What is the future of video disc systems? Reports from both America and Europe suggest that it may not be very bright. The biggest blow is the announcement by RCA, in April, that it would cease manufacture of its Capacitance Electronic Disc (CED) players which it pioneered and which reputedly will involve writing off \$US100 million.

While RCA is not the only manufacturer of CED hardware, its pullout has shocked current owners (about 550,000 in the US) who fear that both maintenance and software may begin to dry up. RCA has tried to allay these fears by announcing that it will

continued to supply software and provide service.

In spite of this the impact has been widespread. Video Shack has announced an across-the-board slashing of software prices to less than \$10 per disc, suggesting a short life and a merry one for disc fans. At the same time Home Video has cancelled plans to put some top line pictures on disc.

CBS/Fox is taking a brighter line, with a positive statement that they intend to continue producing software, but other producers, such as MGM/UA and RCA/Columbia, are adopting a more cautious wait-and-see attitude.

Meanwhile, in Europe, the Philips Laservision system is in similar trouble, with poor sales of both hardware and software. Thorn-EMI appear to be faring a little better with their VHD system but, overall, the videodisc scene looks pretty bleak.

## Microwave radio link contract for AWA

Amalgamated Wireless (Australasia) Limited has been awarded a \$4M contract with the Department of Defence for the supply, installation, commissioning and post commissioning support of microwave radio systems connecting major sites for the Defence Integrated Secure Communications System (DISCON).

The microwave systems were designed by AWA and feature radio systems made by Telettra (Italy) with whom AWA have enjoyed a long and close association. These radio systems have a proven reliability, operating in extreme environments in such countries as Spain, Mexico, Yugoslavia and Argentina.

The all Australian design and installation effort will contribute to the achievement of an overall Australian content in excess of 75% of the contract value.

## News from silicon glen

The glens of Scotland are no longer simple rural areas producing peat moss, wool, and whisky. A \$US150 million investment at the Greenock, Scotland, plant of US electronics giant National Semiconductor will triple output of semiconductor wafers there, at a time when worldwide supply cannot keep up with the demand for silicon chips.

The expansion is the largest single investment to be made in Scotland's electronics industry, although the country has been very successful in attracting high technology companies with tax incentives and government subsidies over the last few years. There are now almost 300 companies in the electronics sector alone, with more than half of the United States' top 20 electronic companies now manufacturing in Scotland.

The Greenock plant, set up at a cost of \$US1,125 million, is the only National Semiconductor plant outside the United States producing silicon wafers, the essential first stage in the manufacture of integrated circuits. Output at the plant is expected to reach 500,000 wafers this year and is set to treble by 1989 with expanded production facilities and the installation of new technology.

## Aussat ground stations under construction

Construction work on the major city earth stations of the Aussat network is progressing on schedule, with the two tracking, telemetry and control (TTC) stations in Perth and Sydney nearing completion. Contracts have recently been let for other stations in Melbourne, Adelaide, Canberra and Hobart and construction is under way.

Contracts for the construction of the Brisbane earth station have also been let and work has begun on the Darwin station.

The eight earth stations will complete the major city Aussat network and provide the main communications access points to the two Aussat satellites. Each earth station is expected to cost \$3 million, including the building, antennas and communications equipment. The first 13 metre dish antenna was installed at the Sydney Belrose station in March.





## Win a Javelin ultra-light aircraft

This is the Javelin light aircraft, similar to one being offered as first prize in the Dick Smith Electronics DSX-Press Bank Cheque-Back Competition, full details of which will be found in the Dick Smith Electronics mailer enclosed with this issue.

The Javelin is an all Australian aircraft, using the latest material and

construction technology. It has a maximum level speed of 88km/h (48knots), climbs at 240m (800ft) per minute, and has good manoeuvrability.

It is designed to comply with the appropriate air navigation order (95.10), is Department of Aviation approved, and requires no licences to fly. Controls are conventional joystick and rudder bar and

it is claimed that even a novice can learn to fly it in a few minutes.

The engine is a 28bhp two stroke, but a 35bhp in-line twin is available as an option. The prize Javelin will be equipped with flight instruments, streamlined engine nacelle, and electric start. Take-off and landing speeds are low at 35km/h and require only a few metres run — depending on the wind. It is valued at \$8775.

## ELF/laser submarine communications

The US Navy is proceeding with the development of its extra-low frequency (ELF) radio system (30 to 300Hz) for the transmission of emergency information to deeply submerged submarines. It is also very much interested in an alternative blue-green laser system, although this will probably not be available for some years.

Deputy Under Secretary Ronald R. Latham recently told the US Congress Defence Committee that although ELF and the laser system have the disadvantage of rather limited data rates, the laser system has the additional problem of being almost useless in bad weather conditions and stormy seas.

The construction of the ELF transmitter system in remote areas of Michigan and Wisconsin is expected to take at least a year. The long wavelengths involved means that the antennas will be measured in tens of miles. Limited transmissions could begin this year however, and a current

(prototype) ELF system at Clam Lake, Wisconsin, may be used to provide so-called "bell-ringer" type signals. These will be continuous transmissions, with an interruption indicating that an emergency exists. This technique was chosen to discourage any attack on the

transmitter site itself.

Several environmental groups in the United States have opposed the ELF transmitters on the grounds that high power, low frequency transmissions could have harmful effects on plant and animal life in the vicinity.

## Answering service for mobile telephones

A call answering service for mobile telephone customers is now available in Sydney and Melbourne, with a service for Perth and Brisbane scheduled to begin later this year.

Mr Ken Douglas, the NSW State Manager of Telecom, said that the new message taking facility will benefit customers whose mobile phones are either out of range, switched off or unattended. "Recent research indicates a need for a call answering service, which will be offered as an optional extra to some 1,500 existing mobile telephone customers and all new customers".

The service links telephone exchange operators, Telecom's "Telefinder" radio paging service and mobile telephone in vehicles and marine craft. Using the system, callers unable to reach a mobile telephone number can ring an operator and leave a message. The operator then alerts the mobile telephone customer through the radio pager, and when convenient the customer can ring the operator to collect the message.

In the event of a message not being collected within four hours the operator will re-page the customer (between 8am and 8pm). Further developments of the system will also allow calls to be diverted to numbers pre-determined by mobile telephone customers.



# News Highlights

## Go ahead for digital TV

Digital processing of analog TV signals within the television receiver offers a number of advantages to manufacturers and viewers alike, and the first digital TV sets should appear on the market in Europe and the United States this year.

All of the receivers going into production are based on a set of seven VLSI chips developed by ITT. The company itself is planning to produce 400,000 digital receivers this year, with Grundig and Blaupunkt also going into production using the same chip set.

In the United States, Zenith and General Electric are also buying the ITT chips and are expected to produce digital receivers this year. Panasonic, Sony and Sharp have also announced plans to produce receivers based on the same integrated circuits.

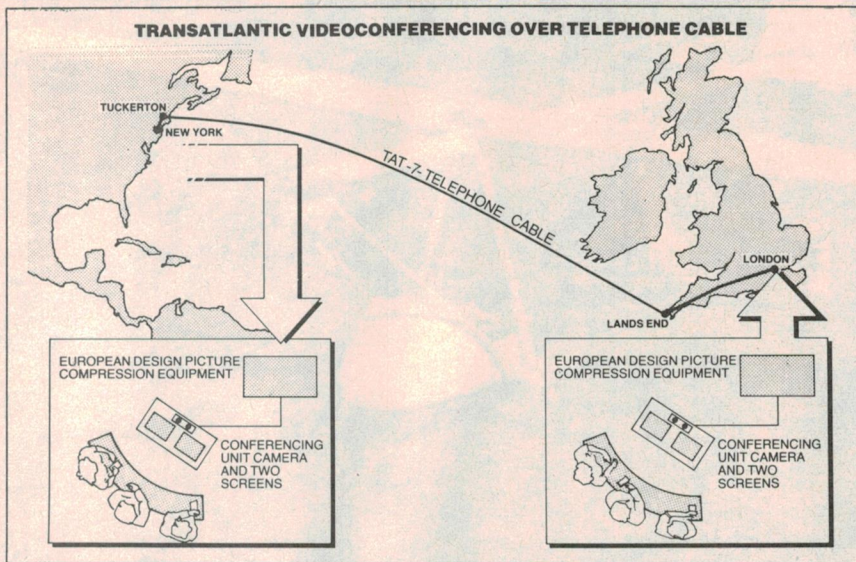
The main attraction of digital TV designs is their improved flexibility. Features such as teletext, ghost-eliminators, "picture-in-picture" windowing, still picture and higher resolution can be added easily, either by programming the existing chip set or by adding additional logic. Multi-standard sets, capable of displaying PAL, NTSC and SECAM signals at the touch of a switch are also a possibility.

ITT has already displayed a VCR programming system that works with its digital receivers. The system, still in the development stages, works with teletext equipped sets. A teletext page listing future TV programs can be fed into the receiver's memory and used to automatically program an attached VCR to record selected program transmissions automatically.

## Taiwan takes on IBM

According to reports from International Resource Development Inc and other industry observers, several companies in Taiwan and Hong Kong are ready to "flood" world markets with "lookalike" copies of the IBM Personal Computer. IRD researchers speculate that IBM may decide to license some of the Asian companies rather than attempt to stop them with legal action.

Such a licensing program would not hurt IBM, which can barely keep up production to meet current US demand for its PC, but it may severely affect other manufacturers of IBM workalikes such as Compaq, Columbia and Radio Shack. Some of the Asian PC compatible models are expected to sell for less than half IBM's price.



## UK-USA video conference facilities introduced

Colour videoconferencing services to the USA using advanced techniques of digital compression have been successfully launched by British Telecom International (BTI). This advanced form of communications, which allows groups of people in the two countries to see and hear each other as if they were face-to-face, is now available between British Telecom's Confravision studios in Britain and videoconferencing rooms across the

USA operated by the American Telephone and Telegraph Company (AT&T) or available to Satellite Business Systems (SBS).

The new international services use high-speed digital transmission links between international exchanges in the two countries, providing full-motion video and audio communications. They follow the setting up of the first digital video conferencing service to Canada in February.

## Progress report on AUSSAT

Australian engineering specialists and other technical personnel are working on site at Hughes Aircraft Company's El Segundo, California facilities where

Australia's domestic satellite system is taking shape. Hughes is building three HS376 satellites for Aussat the first two of which are due for launch on the space shuttle in mid 1985. Pictured from left: Ken Burrill of Hughes, Russell Hinwood, Dave Solomon and David Hollingsworth, all of Aussat.







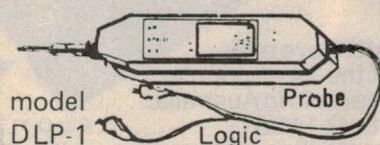
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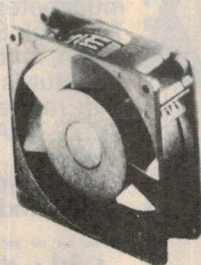
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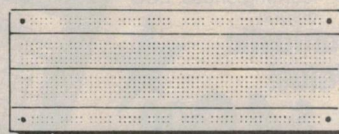
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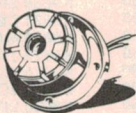
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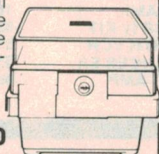
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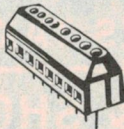
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*Of all Australia's scientific achievements, the Interscan aircraft blind landing system ranks as one of the most significant. Designed by the CSIRO, it has been chosen for world-wide use over designs from Europe, the UK and the USA.*

by PHILIP WATSON

Ever since man began flying he has been acutely aware of the weather and the hazards it presents, particularly in regard to visibility. A sudden "closing in" of rain or fog can blot out the landscape and make any landing a hazardous manoeuvre.

This was less serious while flying was mainly a sport or hobby. When the weather looked threatening, or the forecast was doubtful, wise pilots simply did not fly (unwise ones sometimes did — and paid the price!).

But with the advent of commercial flying came the need to maintain regular schedules. People flew to save time, and a diverted aircraft defeated the whole purpose of the exercise — to say nothing of the added cost to the airline.

Many radio aids were developed over the years, ranging from simple radio telephone circuits (for "talk-down" procedures) to beacons, direction finding

equipment, radio altimeters, and a host of similar devices. These were useful to a degree, if the weather was only moderately bad, but not a real answer.

### The ILS system

The most satisfactory solution, until recently, was the Instrument Landing System (ILS). Introduced as an internationally agreed standard in 1949 it has served the aviation industry well for 35 years, and has been installed in over 500 airports throughout the world.

While a detailed description of ILS is not warranted, a brief run-down will give the reader a better idea of the problems and limitations which lead to the development of Interscan.

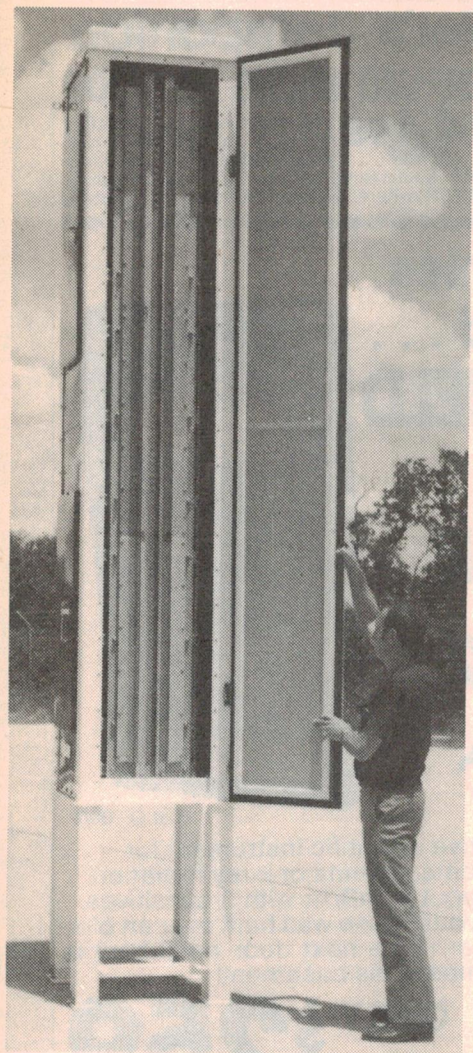
In simple terms, the ILS radiates two narrow radio beams in line with the runway. One, the localiser beam is on VHF between 108 and 112MHz. The other, the glide slope beam, is on UHF between 329 and 335MHz. This beam is tilted upwards at 2.5°.

The idea is for the aircraft to fly along these beams to within sight of the runway, using an ingenious system to keep it "on the beam". By a complex system of antennas and sideband modulation the localiser beam appears, to the aircraft, as two beams — a left beam modulated with a 90Hz tone and a right beam modulated with a 150Hz tone.

Australian designed elevation antenna giving 1.5° vertical beam width. Overall height is 3.6m, aperture height 3.16m.

# Interscan

## *Australia's aircraft*





When the aircraft flies along the centre of this beam it receives both tones at equal strength. These signals are processed and fed to a galvanometer (centre zero) type meter which, in the above situation, would remain in its centre position.

Should the aircraft drift to the left, the 90Hz tone will predominate and the meter will swing to the right, indicating "fly right". Similarly for the reverse situation.

The glide slope system is similar. In this case the 90Hz tone is above the glide path and the 150Hz tone below it. A second galvanometer has its needle mounted horizontally, and is usually housed in the same case to give a "crossed needles" display. If the aircraft is too high this needle will drop, indicating "fly down", etc.

Finally, there are marker beacons; at least two and sometimes three. They operate on 75MHz and beam a signal directly upwards at various distances from the runway. The exact positions are listed in tables or charts for each runway.

Typical distances would be 5km to 8km for the first (outer) marker, 1000m for the second (middle) marker, and 300m for the third (inner) marker, where fitted. These provide a cross check for the pilot who, for a typical Category II

landing would expect to sight the ground as he passed the middle marker, and the end of the runway shortly after. If not he would abort the landing (for landing categories, see table 1).

The inner marker is used for high precision Categories III landings, by pilots and aircraft officially rated for such manoeuvres.

Within its acknowledged limits the ILS has proved highly reliable, and has added immeasurably to the safety and smooth running of the aviation industry. But it does have limitations and in recent years these have become more serious.

A major problem is that it provides only a single, fixed, approach path in line with the runway. Thus, it can normally serve only one aircraft at a time. It also means that the aircraft is committed to that approach path, regardless of the surrounding terrain or the population under the flight path, and the noise problem they will experience. This is further aggravated by the relatively low approach angle.

Another problem concerns the glide slope path. Its angle is dependent on the ground in front of the antenna, which needs to be flat over a large area in order to preserve the beam accuracy. In practice this is often a difficult and expensive requirement to satisfy and, in

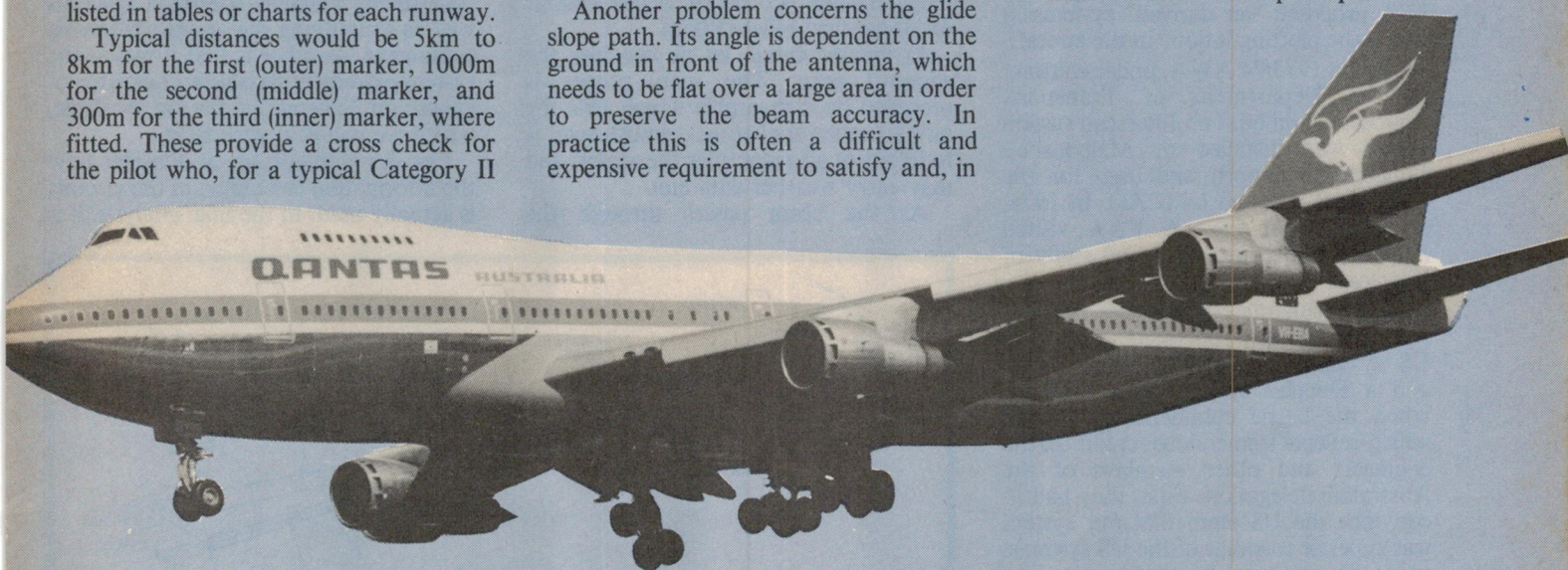
some cases, impractical.

Thus there are some airports, particularly in hilly or mountainous terrain, where ILS simply cannot be used. In others its use is restricted and, even without these problems, the limitations on capacity and noise pollution still exist. Other limitations include susceptibility to RF interference, reflections from buildings, taxing aircraft etc, and the limited number of channels available.

### The Interscan system

As long ago as 1960 it was obvious that planning for something better should begin. The International Civil Aviation Organisation (ICAO) began studying the requirements of a new approach and landing system and, by 1972, these requirements were agreed to internationally. Member countries were then invited to submit proposals as to how these could be met in both concept and hardware.

This was what prompted the



# blind-landing system



# Interscan

development of Interscan, a totally Australian concept. It was conceived by Australian scientists at the CSIRO, designed by them, and built by Australian engineers, mainly at Amalgamated Wireless A/Asia (AWA) under CSIRO supervision.

The concept of the system was proposed by the CSIRO to the (then) Department of Civil Aviation late in 1971, even before the operational requirements had been formally agreed to. To prove the feasibility of the concept the CSIRO demonstrated an experimental model during 1972.

In 1973 Australia proposed the idea to the ICAO. Other proposals were submitted by the United Kingdom, West Germany, USA and France. Of these, France and Germany submitted "ground derived" systems (systems where the aircraft position is determined by a ground station, then radioed to the aircraft), while the UK, Australia and USA proposed "air derived" systems in which the plotting is done in the aircraft.

During 1973/74 AWA, under contract to the Department of Transport, engineered and built an Interscan system which was installed at Melbourne's Tullamarine airport, and used for the flight trials required by ICAO. In 1974, engineers from the US FAA visited Australia and made a detailed study of Interscan.

As a result the concept was taken to the US to be compared with two US systems; a scanning beam system and a Doppler system. And this was when the battle commenced; a battle which reflects tremendous credit on the engineers and other members of the Australian delegation. First, they had to convince the US team that our system was superior to either of the US systems, then that it was also superior to the British and European systems.

And they succeeded. In 1975 the US announced that it had adopted the Interscan principle (they called it Time Reference Scanning Beam, or TRSB) for its submission to ICAO. The ICAO spent the next two years evaluating the system and finally recommended its adoption in 1977. It was formally accepted by all member countries in 1978.

In the light of all the foregoing it is both surprising and disturbing to find that Australia's role in this development has subsequently been completely ignored overseas. In all the overseas literature I perused in preparing this article, some of it quite detailed technically, Australia was never even mentioned!

## How it works

Just how outstanding a breakthrough the Interscan system represents can be better appreciated by looking at it in some detail. The system uses two scanning beams, one scanning in azimuth (horizontally) and one in elevation (vertically). By noting when the aircraft intercepts these beams it is possible to calculate its vertical and horizontal angles to the runway. Its distances from the runway is determined by a conventional DME (distance measuring equipment) system.

The azimuth beam normally scans  $40^\circ$  either side of the runway centre line, although  $60^\circ$  systems have been proposed. The scanning rate in this mode is at least 12 times per second, but can be faster in some configurations. The elevation beam scans from the horizontal upwards to  $15^\circ$ , with a scanning rate of at least 36 times per second.

Unlike the ILS, which operates in the VHF/UHF bands, Interscan operates in the SHF band between 5.03 and 5.09GHz (the "C" band). It has a range of 20 nautical miles (37km).

In greater detail, let us consider the azimuth scan. The scan proper is preceded by a preamble which tells the aircraft receiver that an azimuth scan is to follow (it also identifies the airport and may carry weather data etc).

As the beam passes through the

aircraft the aircraft receiver detects it and an associated processor starts a timing cycle. The beam completes the first half of its scan — the "to" scan — then sweeps back on its "fro" scan. The receiver again intercepts the signal and the processor terminates its timing cycle. Given the angle over which the scan sweeps and the time taken for the sweep, the processor thus uses the time between intercepts to calculate the aircraft's angle to the runway.

The same process is used for the vertical scan and calculation, giving two of the three pieces of information necessary to calculate the aircraft's exact position. The third piece is the distance from the runway which, as already mentioned, is determined by DME.

A vital point about these two scans is that they are transmitted sequentially, the preambles being used to identify each scan. This (time multiplex) system offers several important advantages.

An obvious one is that the same frequency can be used for both scans, thus saving valuable spectrum space as well as simplifying the aircraft receiving equipment. Another is that it makes the system extremely flexible and capable of expansion. Several options are available, which we will deal with later.

For the moment, let us consider how the information calculated in the aircraft is actually used. In the final analysis, it is

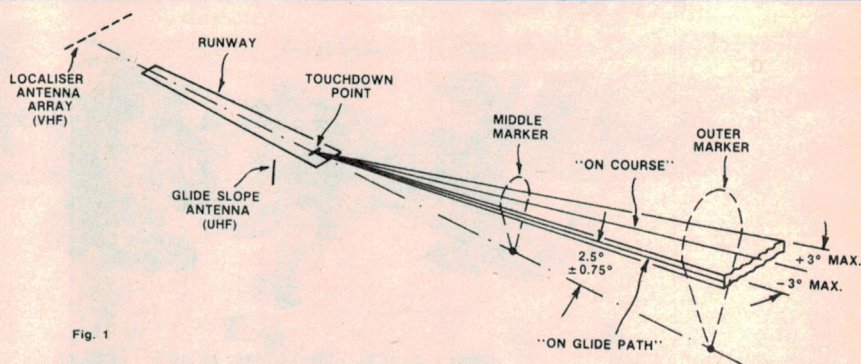


Fig. 1

The instrument landing system currently in use employs fixed horizontal and vertical beams, and provides only one approach path. It is also difficult or impossible to install in some locations.

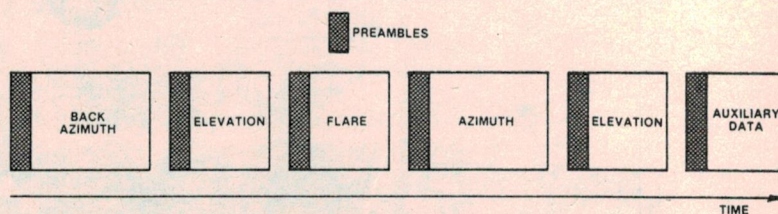
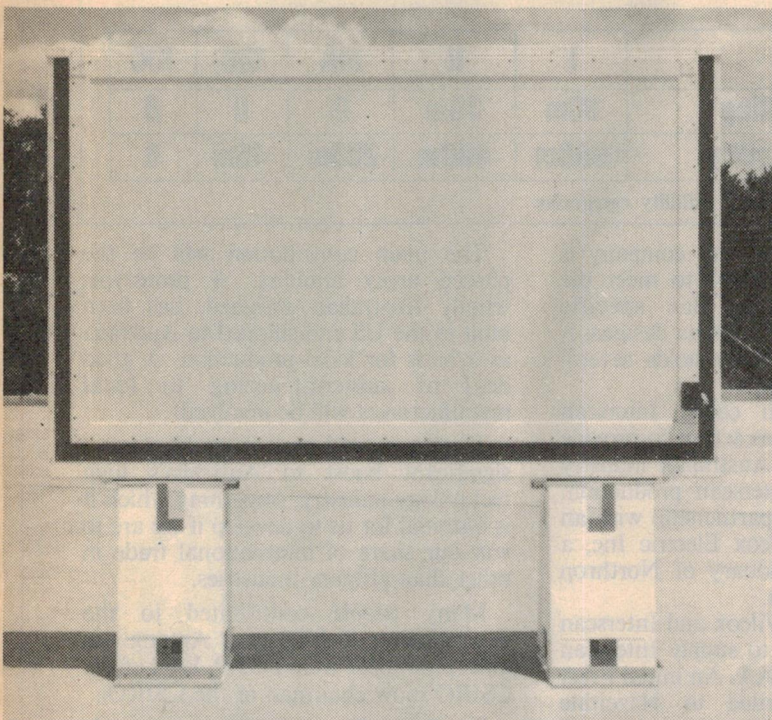


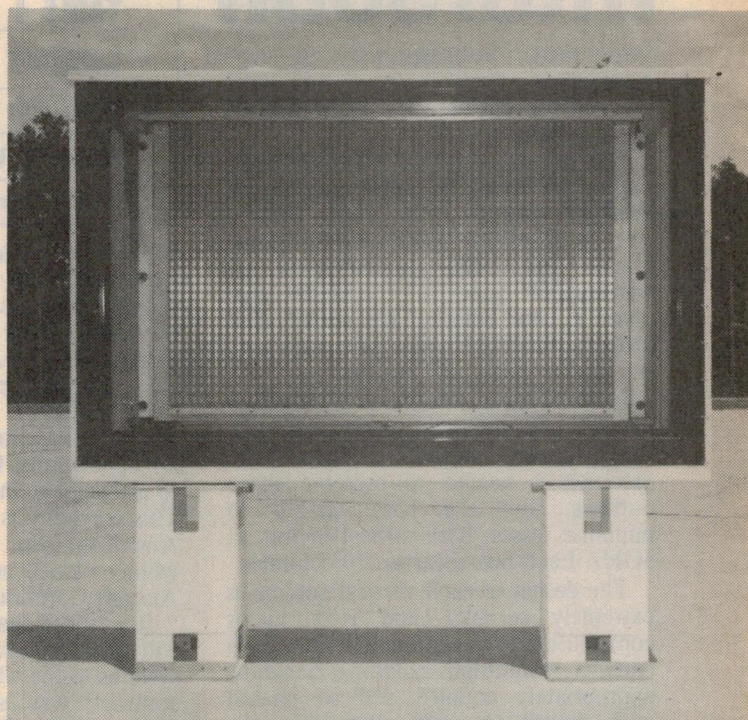
Fig. 2 TIME-MULTIPLEXED FUNCTION SIGNAL FORMAT

A complex interscan installation can provide all the functions shown above, but a very simple one may provide elevation and azimuth only. The preamble for each function makes all installations compatible.





Australian designed azimuth antenna with 2° horizontal beam width. It is 2.7m wide overall and 1.72m high.



Azimuth antenna with cover removed showing the complex array of radiating elements. Active area is 1.85m by 1.23m.

the air traffic controller on the ground who makes the decision as to the approach path each aircraft should follow, making due allowance for separation. To fit this requirement, the on-board processor is programmed to plot a large number of paths to the runway, and these may be straight or curved.

In a typical case involving Interscan the air traffic controller would instruct the pilot to approach on (say) track 25. The pilot would feed this instruction into his processor using a magnetic card, numeric keyboard, or similar interface, and the processor would then compare the aircraft's actual position with the nominated path and generate the appropriate correction signals.

These signals can be used in several ways. One of the simplest is to feed them to the traditional dual galvanometer display, as used with the ILS, from which the pilot flies left or right, up or down, as needed to keep the aircraft on the selected path.

At the other extreme the information can be fed directly to the autopilot, so that the aircraft virtually flies itself along the path. The type of hardware selected is, of course, largely a matter for the airline to decide, depending on what it feels it needs, and can afford.

Thus, in theory at least, Interscan can provide an infinite number of approach paths and, in practice, as many as are likely to be needed in any air traffic situation.

### Options and advantages

Earlier, we mentioned optional features. One of these is a flare guidance system, essential for category III landings, which takes over for the final approach and flare out before touch down.

Another facility is called "back azimuth". It provides a continuation of azimuth readings in the event of missed approach, ie, where the pilot is forced to abort the landing and go round again. This uses a second azimuth antenna at the opposite end of the runway.

Another option is the transmission of auxiliary data in blocks between the previously described functions. Because all these functions are preceded by an identifying preamble, it does not matter in what sequence they are transmitted. Also, it is unnecessary for all airports to provide all the functions.

Compared with the old ILS system, Interscan offers a number of very important advantages. It can handle several aircraft at the same time, by assigning them different tracks. It can bring aircraft in on a curved approach in order to avoid terrain hazards, or to minimise noise pollution over built-up areas. Noise pollution can be further reduced by prescribing a higher approach altitude for as long as possible. The system is virtually immune to multipath reflections and is largely independent of the terrain in front of the antennas.

It's accuracy is also extremely high. The ICAO specifications called for an

accuracy in both azimuth and elevation of not more than 0.1° deviation by the aircraft from the assigned path. In tests conducted at Tullamarine, Interscan consistently bettered this by a factor of 10, ie, it held the aircraft within .01°, or 0.5m at touchdown.

### The equipment

In terms of hardware, the most demanding part of Interscan is undoubtedly the antenna system. Not only must it produce a very narrow beam (typically 1°) in one axis of each beam, but it must also be able to sweep this beam to and fro (or up and down) at high speed and with a high order of accuracy.

Mechanical sweep systems were obviously unsuitable; they could provide neither the sweep repetition rate nor the accuracy. Since Interscan was first conceived its creators have designed, built, and tested three types of antenna; the torus, the Rotman lens, and the phased array.

The torus consists of a large, roughly semicircular, reflector, energised from a bank of antennas in front of and directed at it. By energising these antennas sequentially, in a graduated pattern, using electronic switching, it is possible to produce a smoothly swept beam. The torus antenna was used for the evaluation trials at Tullamarine.

The Rotman lens system was originally visualised as being suitable for small airfields where limited sweep could be accepted and minimum cost was



# Interscan

important. Subsequently it was established that it was not cost competitive against the latest phased array system.

The phased array consists of a large number of vertical columns, typically 58, arranged side by side. Each column consists of several radiator elements, one above the other, connected by transmissions lines. By varying the signal phase to each column, sequentially and proportionally, the array generates both the narrow beam and the sweep.

Each vertical column is a precision etching, printed circuit board style, on a high quality insulating base. The precision is needed to preserve sharp outlines, and the base quality to minimise losses, both critical factors at 5GHz. Each board carries 10 columns.

The design of each vertical column is extremely complex and is a major contribution to the antenna design. Each consists of multiple radiating elements, appropriately coupled and so phased with regard to each other that the resultant beam has virtually no downwards radiation and is thus little effected by the terrain.

Australia is well to the fore on the commercial side. The Interscan concept

TABLE 1

Category	I	II	IIIA	IIIB	IIIC
Minimum ceiling	60m	30m	0	0	0
Forward visibility	900m	400m	200m	45m	0

TABLE 1: restricted visibility categories

is not patentable and any company is free to develop hardware to meet the ICAO specifications. But specific hardware, as for the antenna designs, is patentable and Australia holds several such important patents.

In 1978, a firm called Interscan Australia Pty Ltd was set up to provide an opportunity for Australian industry to participate in Interscan production. This company is in partnership with an American firm, Wilcox Electric Inc, a wholly owned subsidiary of Northrop Aircraft Corporation.

It is hoped that Wilcox and Interscan will win a contract to supply Interscan systems to the US FAA. An initial FAA contract was awarded to Hazeltine Corp., but the FAA is expected to call tenders for more systems during 1985. If Wilcox wins this contract, 50% of each system will be made in Australia. Each system will be worth approximately \$1 million.

The main contribution will be the phased array antenna. A prototype, wholly Australian designed, has been built in the US and shipped to Australia as a basis for local production. A good deal of sub-contracting to local manufacturers will be involved.

If all goes as hoped it could mean a significant boost to Australia's high technology industry; something which it is essential for us to develop if we are to win our share of international trade in other than primary industries.

Many people contributed to the development of Interscan. Among the most prominent were Dr J.P. Wild of the CSIRO (now chairman of the CSIRO).

Dr D.N. Cooper, CSIRO; and Mr H.C. Minnett, CSIRO (now consultant to Interscan Australia). The author is particularly grateful to Dr Cooper and Mr Minnett for their assistance in preparing this article. ☺

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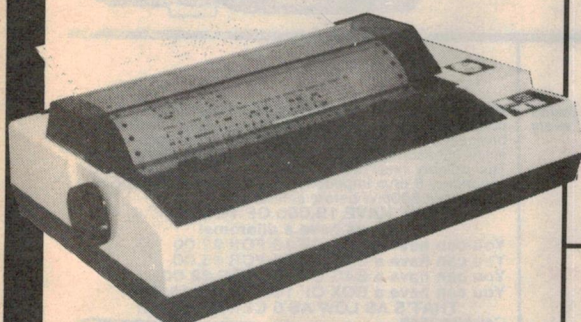
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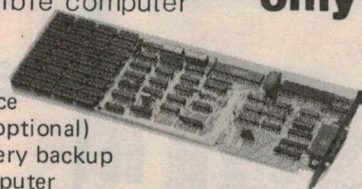
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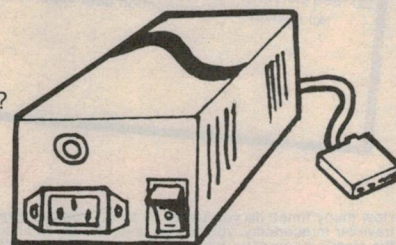
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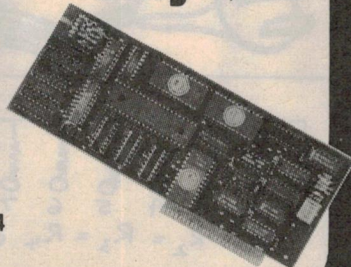
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The Turntables are made in England by B.S.R. They are unmounted and suitable for Disco Consoles, 3-in-1's etc. They are also ideal as replacements for existing 3-in-1 sets. (See specifications).

But there is an aspect that is **really amazing!** You can work the Turntable from 9-12V DC. This means that you can run the unit from a car or truck!! (The AA0292 model can of course run on 240V mains).

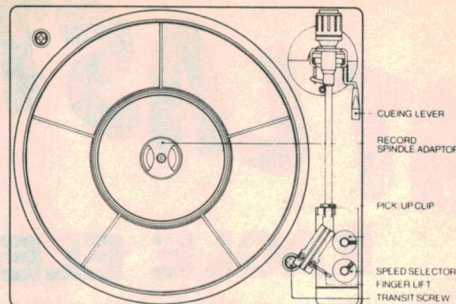
The Turntable features quality Belt Drive operation, lightweight Transcription type arm, Cueing facility and Stereo Ceramic cartridge with Diamond Stylus. The platter has calibration markings to check speed. A simple neon on 240V will "strobe" to the markings. Whilst the 33 & 45 rpm speed has been accurately set in the factory, you have the facility to make pitch adjustments underneath the turntable.

The DC Motor Drive (as used in the best turntables) is electronically controlled!!

Each unit comes with complete instructions. Quantity limited! You will have to hurry to avoid disappointment.

### SPECIFICATIONS:

- ★ Dimensions 330(W) x 285(D) x 60(H)mm overall
- ★ Platter diameter 280mm
- ★ 2 speed - 33 & 45 rpm (internally adjustable)
- ★ Pick-up arm counterbalanced type with cueing facility
- ★ Pick-up ceramic (stereo) with diamond stylus
- ★ Turntable operation - auto stop, will return to rest automatically. Turntable chassis is sprung on all corners with transit screws & clips
- ★ Output stereo RCA sockets underneath unit
- ★ Weight 1.5kg



Check the price! Cat. AA-0290  
(Requires 9-12V DC @ 500mA)

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240V version - (includes 12V 500mA adaptor)

Cat. AA-0292 **ONLY \$39.95**

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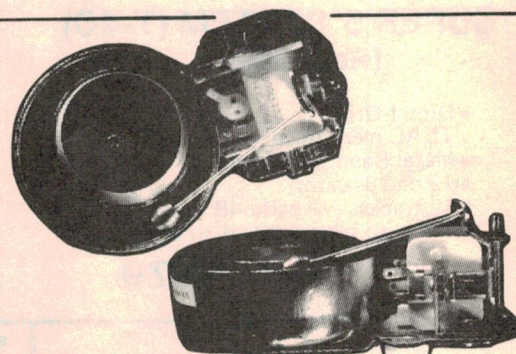
Jaycar has bought the entire surplus stock of a coaxially mounted electric bell - as used in the Telecom 'Gondola' telephone! This unique bell is actually TWO bells - one mounted coaxially inside the other. The striker is mounted between the rims of the bells and is electromechanically driven. The unit runs on AC from about 17-48V.

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ZD1875 0.6"(15mm)	Comm Anode Red	\$2.50	\$2.25
ZD1880 0.6"(15mm)	Comm Cath Green	\$2.95	\$2.50
ZD1885 0.6"(15mm)	Comm Cath Yellow	\$2.95	\$2.50

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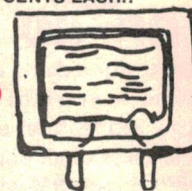
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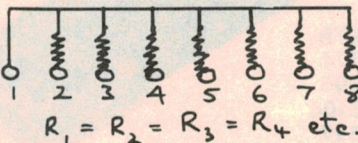
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The networks are wired as per schematic illustration, and all values in each device are the same. As very few hobby circuits feature networks at the moment, we feel that this product will only appeal to the service and OEM industry. If you are a user of resistor networks, send us a note and we will send you a specific list of stock with prices.

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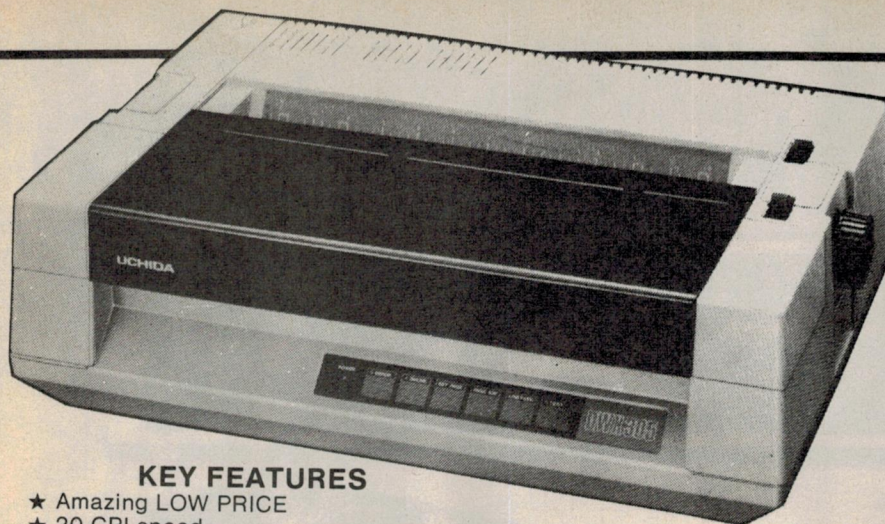
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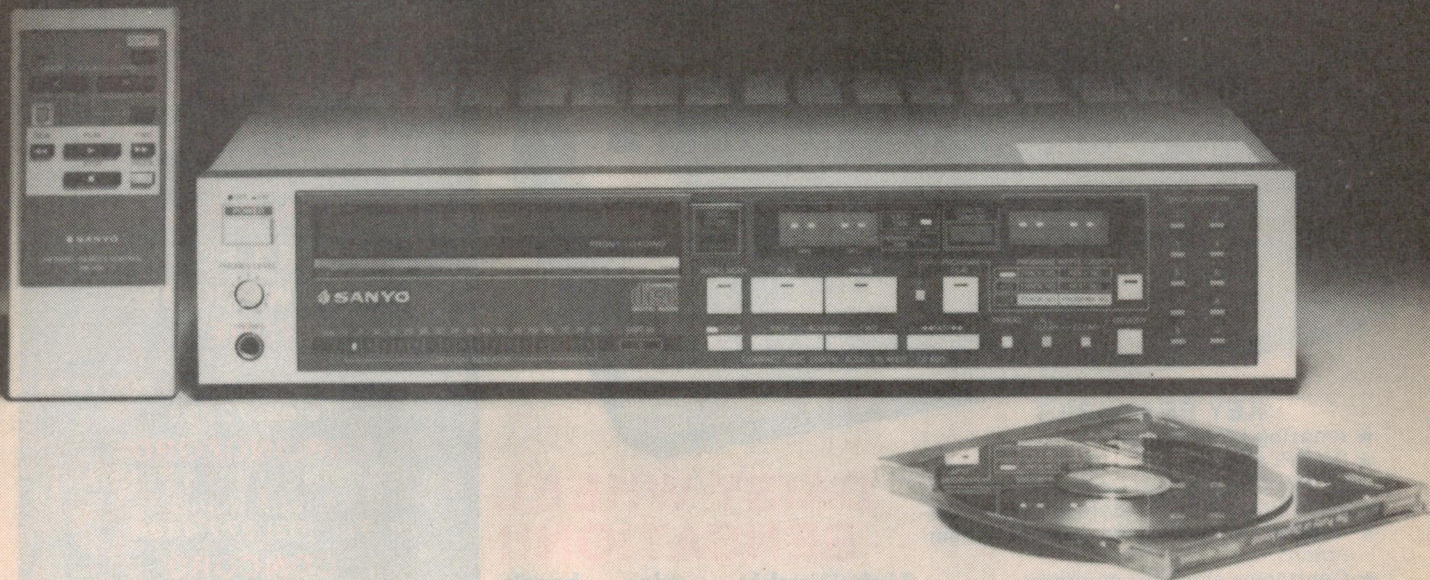
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# COMPACT DISCS...

## *Dynamic range, overload, dither noise*

*As with any new form of technology, compact discs have generated their share of apprehension and uncertainty for the hifi industry and consumers alike. Some of the early worries have been sorted out but others remain to be explained and understood at user level.*

by NEVILLE WILLIAMS

Behind the above introduction lies the fact that the compact disc audio system was developed by a relatively small number of specialists in a few dedicated laboratories, working at the extremes of several branches of technology: the quantisation of audio signals; digital recording and processing; laser devices and laser optics; micro etching and processing; mechanical systems working to "micro" tolerances; ultra-precise servo systems, and so on.

Unlike earlier developments in the record industry, the compact disc was in no sense an extension of established practice and the industry could not absorb it by simply adding another chapter to the book of knowledge. Engineers, technicians, writers, sales staff and users have all had to go back to school again!

In the laboratories, the specialists had debated what was desirable and practical, had examined a variety of possible approaches, agreed upon methods and standards, signed commercial agreements, produced their respective models and then launched the system as a complete, Euro-Japanese package.

That it worked, and even worked well, was patently obvious. The trouble was that virtually no-one outside that select group of specialists could explain the more elusive details — and to do so wasn't their concern, even if there had been no inhibitions about giving away individual company secrets!

In consequence, while the initial announcements were accompanied by a layman's explanation of the broad principles, more detailed and

comprehensible technical information has been harder to come by. It has not been easy for either writers or readers to penetrate the unfamiliar world of digital sampling and decoding, of error detection and correction, of micron-size bumps (pits?) and tracks, of lasers and laser-servo systems, of analog and digital filters, and so on.

Ultimately, the subtleties, the commercial secrets and the mathematics of all these subjects will have to be exposed and re-expressed in readable text, so that notions and unsubstantiated argument can give way to hard fact.

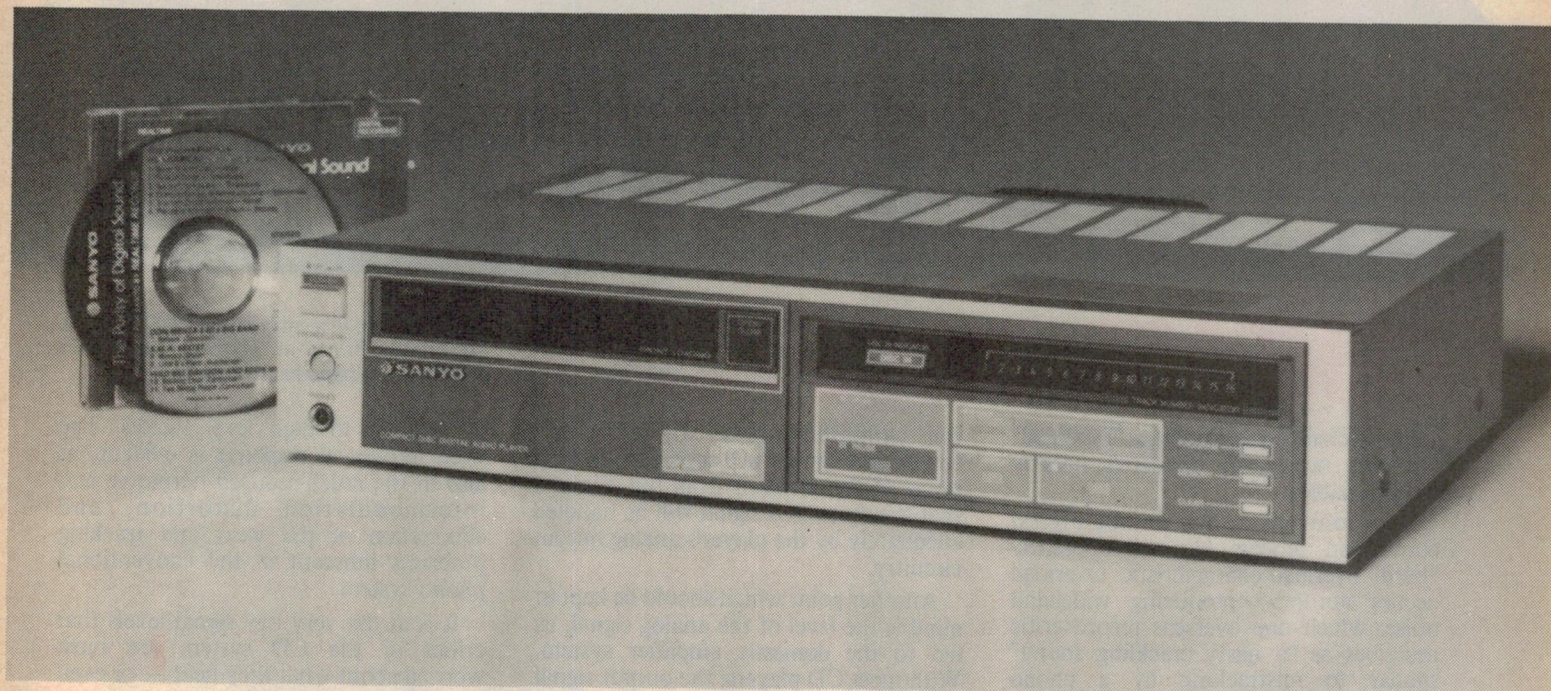
The truth is that, after 100 years of analog recording and playback, hifi industry personnel, writers and enthusiasts are still finding things to argue about. By inference, it will take a while yet for us to assimilate the facts and implications of the digital system, so don't get too impatient!

An early reaction to the compact disc was to boggle at the (comparatively) enormous dynamic range — 90+dB — and to speculate about the dramatic difference it could make to recorded sound. This later gave way to apprehension as to whether a substantial increase in dynamic range could be accommodated in a domestic listening situation.



In their new model compact disc players, CP300 and CP400, Sanyo have opted for slide-type front loading with push-button open/close to achieve a slim-line look. Dimensions are 420(W) x 88 (H) x 320(D)mm. Both models provide normal and 16-track programmable play with repeat, forward and reverse search, pause, and provision for headphone listening, with

adjustable level control. In addition, the CP400 offers a readout of track time and time remaining, index facilities with a separate multimode display, a read-head position indicator, auto sampling of the start of tracks, and a full-function wireless remote controller. Going prices are \$699 for the CP300 and \$899 for the CP400.



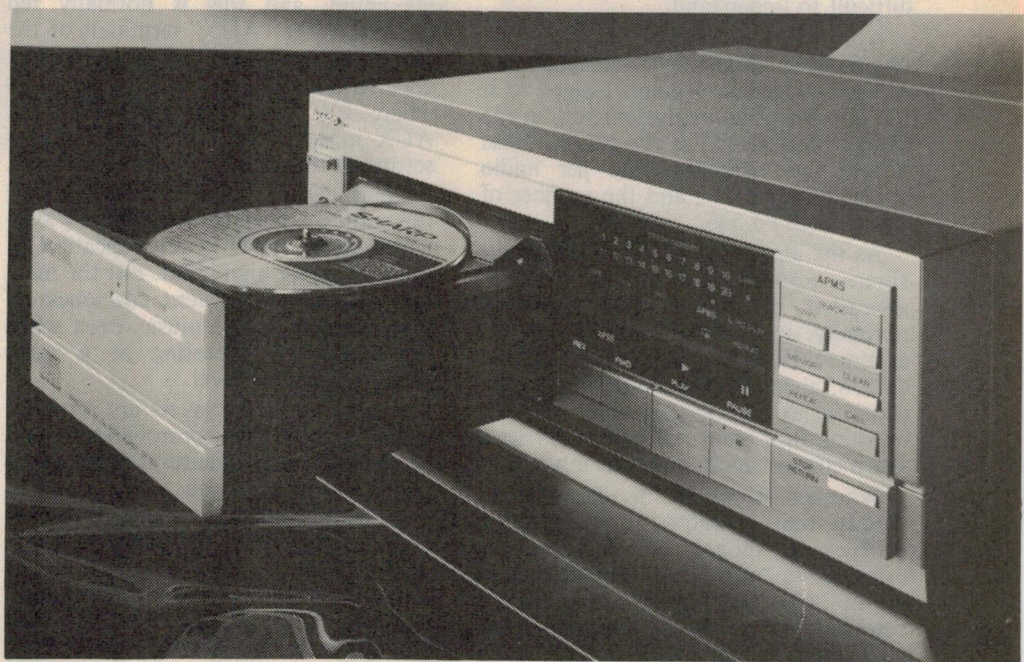
## and all that...

Record companies have resolved that uncertainty in rather pragmatic fashion by simply re-issuing on compact disc their recent, quality masters, notably those which have been digitally recorded. Apart from the virtual elimination of surface noise, the first wave of compact discs therefore has essentially the same signal dynamic range as the more recent prestige analog recordings — thereby establishing a pattern for the future.

It should also have made life easier for recording engineers: the same signal to accommodate, but on discs with a dynamic window maybe 20dB wider. How could anything go wrong?

According to some critics, the short answer to that question is "easily" and they are prepared to put names to certain compact discs which appear to exhibit high-level overload or which, conversely, appear to have been recorded predominantly at the less favourable, bottom end of the digital number stack. (More about that later).

High-level overload can occur in the analog/digital converter ahead of the digital master tape, or between an analog master and the compact disc digital master. It may be due to malfunction of the A/D converter itself or to failure on the part of the operator to preset correctly the input signal level.



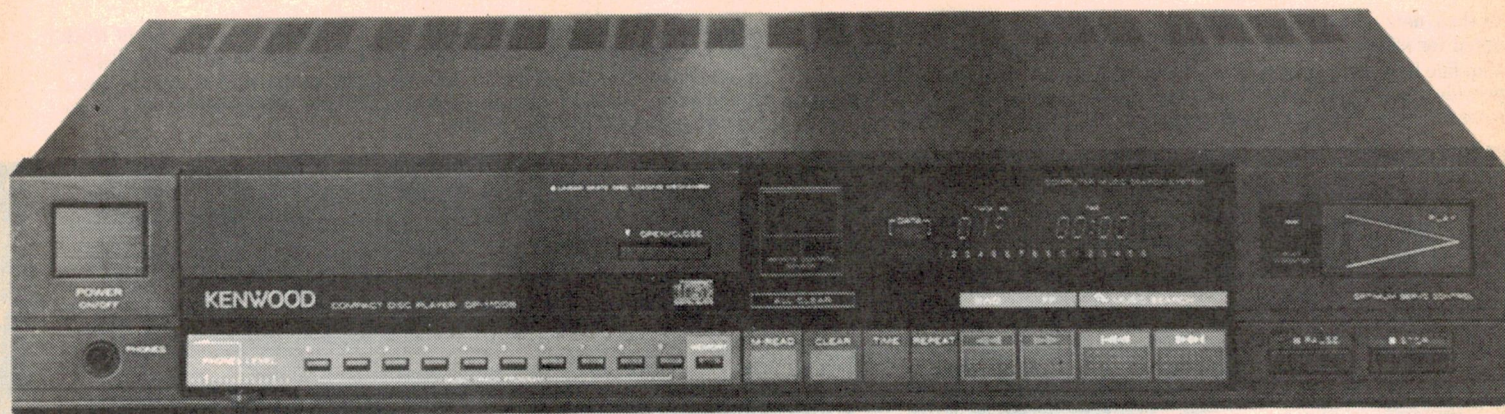
Sharp's new DX-500H(S) compact disc player offers a very attractive balance of appearance, features, performance and price. It provides normal and programmable play, with optional repeat, forward and reverse program search and Pause. LED indicators display the operating mode, elapsed track time and track number up to 20 (directly) or up to 40 (by

observing the "over" indicator). Design features include diecast chassis, touch-button operated loading drawer, headphone socket and level control, and high-performance and analog output circuitry. Dimensions are 33(W) x 104(H) x 345(D)mm and colour scheme silver/grey. The "going" price? Around \$799.

Overload on signal peaks is a familiar problem with analog tape recorders, even in professional situations, but they have the advantage of a "soft" overload

characteristic, with peaks tending to be crushed and somewhat rounded rather than clipped abruptly. With moderate "soft" overload, the character of the





# COMPACT DISCS . . .

sound is changed and perhaps "muddled" but not necessarily rendered harshly objectionable.

By contrast, the analog/digital conversion process has an inherently "hard" overload characteristic. Overload occurs abruptly, producing wideband noise, which one overseas record critic describes as "a nasty crackling sound" similar to mistracking by a phono cartridge. Why this should be so is not difficult to understand.

An A/D converter senses the amplitude of an analog input signal and, at each successive instant, assigns to it the number of an equivalent step in the digital "staircase". For the compact disc system, the sampling rate per audio channel is 44.1kHz, and the number of digital steps 65,536.

As the amplitude of the analog input signal approaches maximum, the allocation of digital levels proceeds normally and with a high degree of accuracy. However, once it reaches level 65,536, that's it; the system can only continue to encode that same number, resulting in a recovered waveform with sharp corners and a very flat top.

Whether it would be desirable to modify that characteristic is open to debate. It should be possible, for example, to "stretch" the topmost steps in an A/D converter so that, when subsequently decoded by a normal linear A/D converter, the overall system would exhibit a soft — and more tolerant — overload characteristic, akin to an analog tape system.

Not surprisingly, quality-conscious engineers have reservations about any scheme which would involve introducing deliberate non-linearity. As they see it, the proper course is to exercise sufficient care with recording equipment and with levels to ensure that overload does not occur in the first place.

Care is equally necessary, in the design of compact disc players, to ensure that

the complementary digital/analog conversion system will cope with the full range of digital levels from the disc and that the recovered signal will be handled adequately by the player's analog output circuitry.

Another point which should be kept in mind is the level of the analog signal, as fed to the domestic amplifier system. With most CD players, the output signal level is specified as about 2V RMS maximum, and this is normally fed directly to the "AUX" terminals of the amplifier. In most cases the amplifier can cope with it but there may be instances where 2V RMS may over-drive the AUX input circuit, irrespective of the setting of the amplifier volume control.

Loud volume from the amplifier with the control advanced by, say, only one-tenth of its travel is an indication of uncomfortably high input. But the main symptom is a consistent coarseness of loud passages in the music, even when the system is operating at a quite subdued listening level.

One or two CD players are provided with an output level control and this can be preset to ensure a natural sweep of the amplifier volume knob. Failing that, it may be necessary to hang a pair of resistive pads or a ganged preset potentiometer across the output terminals of the CD player to limit the L and R signals by at least 2:1. (A 50k twin potentiometer, or a dual resistor pad approximating that impedance would be appropriate in most cases.)

One good point about any such adjustment is that, once set for your CD player and your amplifier, it will remain valid for all compact discs, irrespective of content or source. The peak signal level is set by those 65,536 digital steps and not even Telarc and their "1812" cannon can contrive any more!

Notwithstanding the foregoing remarks, the compact disc system has won widespread approval for its handling

This is Kenwood's entry into the CD field; the DP-1100B. Priced at \$1299 it has remote control and comprehensive facilities.

of medium to high level signals. The wide frequency response is evident, as also in the much-reduced harmonic and intermodulation distortion, and elimination of the wear and tracking problems inherent in the conventional phono system.

It is at the very low signal levels that critics of the CD system are most worried about what they hear — or even what they might hear!

The criticism — and the apprehension — arises when the digital encoding process is considered in relation to barely audible sounds which, of course, are important in the total listening experience. How do they fare?

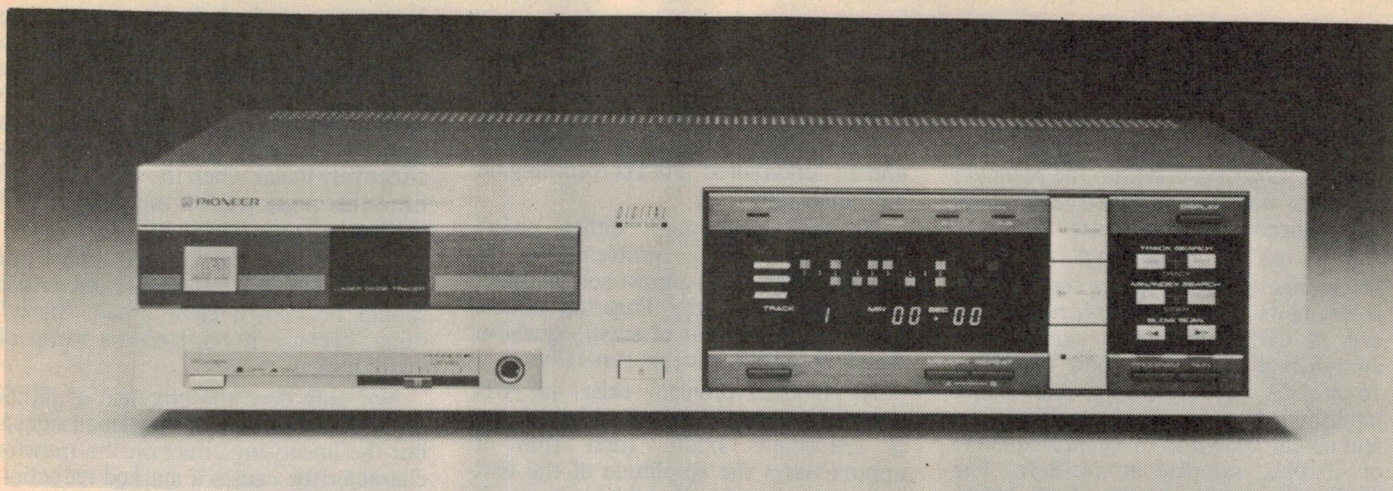
It will be evident that, as the level of signal to be encoded falls, the number of digital steps involved will diminish progressively from 65,000-odd for a high-level signal, to a few thousand steps, then to a few hundred and so on down to a few single steps, at the very bottom of the digital number stack.

In a linear encoding system, as for most digital systems to date, the steps are of equal magnitude. It follows that, as the input signal becomes smaller and smaller, the steps will become a progressively larger fraction of the signal amplitude, resulting in progressively coarser encoding. Critics reason that:

- Coarser encoding must cause a progressive rise in the harmonic distortion percentage, indeed to quite high figures;
- It must cause a similar rise in the quantising noise content; ie in audible by-products of the sampling frequency, notwithstanding the presence of supersonic filtering;
- It may even cause total loss of tiny, lone signals which are individually too small in value to be encoded.

To seek support for these observations, the critics may well try listening to pianissimo passages in CD records





with the volume control well advanced — a rather hazardous procedure if they run into a sudden loud chord. But the favoured recording for the purpose is a limited issue demonstration disc from Nimbus which contains a track originally intended to help assess the noise level and low-level distortion of CD players.

It consists of an “undithered” recording of a 300Hz sine wave, identical for both channels, which starts from literally no-signal and rises smoothly to -40dB, relative to the disc’s maximum signal level of 0dB. It then fades back to no-signal, the exercise occupying a track time of 62 seconds.

One critic reports that, if you play this track with the volume control initially “full up”, the first thing you hear is a buzzing “gritty” noise, with no sign of the 300Hz fundamental. When it does emerge, it is cluttered with noise, which diminishes as the tone gets stronger and you are forced to turn the volume control back. On the fade-down section of the track, the process is reversed.

Pioneer’s PD-70 is a drawer-loading machine which is claimed to have improved tracking and error correction. It is priced at \$949.

Surely, runs the argument, this is evidence enough that the compact disc system should have been engineered in the first place for better resolution of low-level signals, and especially low-level, high frequency signals. Consideration should have been given to:

- the use of 16-bit plus over-sampling or, better still, of an 18-bit or 20-bit system giving a substantial increase in the number of digital steps, or;
- The use of graded steps so that the encoding would more closely approximate the logarithmic loudness response of the human ear; or;
- The use of signal compression/expansion in one form or another.
- The use of a higher sampling frequency.

The message that comes through, in response to such suggestions, is that the parameters and standards adopted for

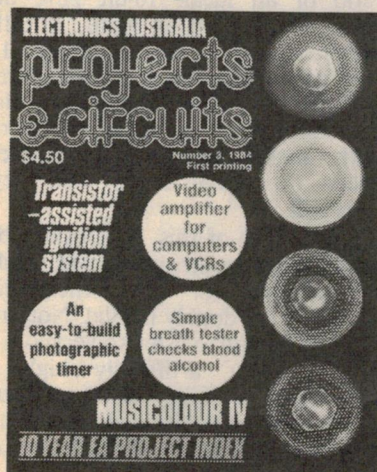
the compact disc system offered the highest possible standard of performance, commensurate with what the industry could reasonably expect to implement within an acceptable time frame.

Mass-produced 16-bit linear chips have posed problem enough without envisaging logarithmic scaling. An 18-bit system and/or a higher sampling rate would both have posed further difficulties with increased bit rate — already 4.3218 million bits/sec. To have insisted on more ambitious standards would have increased the risk of dissension and the possibility of companies acting independently, to produce a multiplicity of systems. It was a risk the industry could not afford to take.

As it is, compact disc offers the highest quality of reproduction from any system available in the home, or likely to be

## projects & circuits

### Number 3



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# COMPACT DISCS . . .

required in the foreseeable future. What is more, scope exists within the accepted standards both for improved technology and reduced production costs.

The rise in noise and distortion percentage with decreasing signal levels is not news to the industry, nor was it ever a dark secret. For example, in announcing their then-new AN6806 16-bit D/A converter chip, Matsushita published linearity curves, theoretical and actual, drawn for a signal frequency of 1050Hz, sampled at 44.1kHz. The THD was shown as rising from below 0.003% at 0dB signal level through 0.1% at -40dB. It was evident that it could reach 1.0% at -60dB and 10% at -80dB.

The figures look horrendous at first glance until one realises that, under practical domestic hifi listening conditions, the distortion products will normally be below the level of perception, therefore subjectively non-existent. In endorsing the CD system, hifi companies worldwide obviously accepted this view.

Indeed, the manufacturers of the Nimbus recording, mentioned earlier, were careful to make the point in their explanatory notes:

**"A stepwise distortion of the waveform is present as an inevitable result of the digital recording process but the distortion, like the beginning and end of the tone itself, should be inaudible at normal listening levels."**

The technique of listening to disappearingly small sounds with the volume control "full up" may have some value as an investigative procedure but it can all too easily lead to a false conclusion. Let me illustrate.

I have LP test recordings with blank grooves in my collection and, of course, unrecorded cassette tapes. To play either with the volume control full up is to hear quite an off-putting amount of noise — but I do not write them off on that account. What really matters is the intrusion or otherwise of such noise in normal program listening, at normal control settings.

It is on that basis that the compact disc system should be judged: set the volume control so that the level of the loudest passages is appropriate to the listening situation — however determined; then settle back and listen. If, in those circumstances, you're worried by low-level distortion or "gritty" quantising noise, we'd be surprised — but you never know: you may have exceptional hearing, an exceptional listening situation, or a fertile imagination!

Then what's all this about dither noise and an "undithered" 300Hz recording on a Nimbus disc?

At first encounter, "dither noise" suggests yet another problem, but it's just the reverse. It's a most helpful effect that can relieve any lingering doubts about the resolution of small signals in digital recording systems generally.

A potential problem exists in A/D conversion when the analog input signal is extremely small, such that it approximates the amplitude of the first step in the digital ladder. Alternatively, it may be thought of as approximating the "least significant bit" (LSB) in the relevant binary number — for 16-bit, number 1 in a stack 65,536 units high or, in audio terms, 96dB down from the top!

With the analog signal oscillating above and below the LSB, and being sampled at unrelated intervals, it becomes essentially a matter of chance as to how, and even whether, it will be encoded.

A simple but surprisingly effective answer to the problem lies in adding a small amount of white noise to the signal, such that the summed amplitude of the two rides randomly up and down the last remaining steps on the digital ladder. When this happens, the A/D converter encodes both the noise and the signal and, in due course, both are recovered by the D/A converter in the replay equipment. Importantly, the wanted signal is preserved.

(By way of comparison, some writers draw readers' attention to the role of DC bias and/or high-frequency bias in class-B output stages and tape recorders in getting the wanted signal on to the linear portion of the transfer characteristic. For the present purpose, they liken noise to a random bias, able to boost a small analog signal up on to a big digital ladder. Call it "dither bias", if you like!)

At first glance, it may seem odd to add noise deliberately to a system which boasts low noise as one of its major advantages. In fact, even after the addition of dither, the signal/noise ratio is still far better than can be attained with even the best analog recorders.

For those able to follow it up, a paper entitled "Resolution Below the Least Significant Bit in Digital Systems with Dither" was presented to the 1982 AES Convention by J. Vanderkooy and S. P. Lipshitz of the University of Waterloo, Ontario, Canada (Paper 1930, D1). Figs 1-4, reproduced herewith, have been adapted from that source.

The effect of dither is difficult to illustrate with a simple diagram but Fig.

2 attempts to show that, as far as the wanted signal is concerned, the provision of a randomly varying noise "floor" has the effect of rounding off the precise rectangular steps of the digital ladder. In fact, the transfer characteristic becomes effectively linear when the RMS value of the dither noise reaches the amplitude of the least significant bit.

(Vanderkooy and Lipshitz point out that the dithered transfer characteristic should be shown as a broad "fuzzy" thing, because it represents a ramp of white noise.)

Not only does the presence of dither ensure the encoding of very small signals but the linearising effect on the transfer characteristic causes a marked reduction in the harmonic distortion of low-amplitude signals generally. The sequence of harmonics shown in the upper section of Vanderkooy and Lipshitz' Fig. 3 virtually disappears, as in the lower section, giving place to white noise at about -27dB relative to the fundamental, in the particular case.

Their Fig. 4 shows the effect of dither on the intermodulation products of two low-level tones, respectively at 600Hz and 1000Hz. The forest of spikes gives place to a band of white noise, again about 27dB down from the fundamentals.

Vanderkooy and Lipshitz emphasise that, contrary to what might be expected, white dither noise is effective for all frequencies in the audio pass band. Non-linear products, as such, tend to be suppressed and dispersed into the noise, becoming part of it and subjectively indistinguishable from it.

"With sufficient dither," they say, "a digital system loses all its digital artefacts". Signal levels below the digital noise floor continue to be encoded, with the possibility of being subjectively discerned, much as happens with signals beneath the noise floor of an analog system.

To put figures to this, the signal/noise ratio of an ideal, 16-bit pure digital system is quoted as 98dB. If 3dB of dither noise is added to the signal, the new noise floor might be considered as -95dB. But, with dither present, signals can be recorded below the noise floor, as with analog system, giving potential access to signal levels well beyond -100dB.

In the face of this, conclusions based on listening to an undithered track on the Nimbus (or any other) digital recording are doubly invalid. Not only is it inappropriate to listen to very low-level signals under artificially high gain conditions (volume full up) but a deliberately non-dithered recording is untypical of good practice or even ordinary practice.



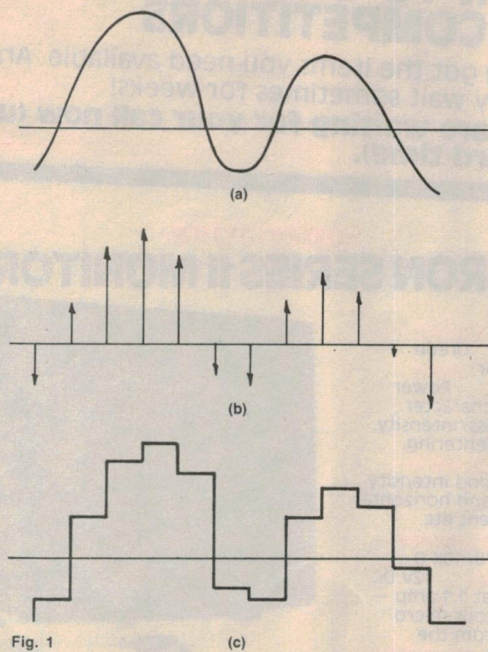


Fig. 1

This shows digital sampling of an analog waveform; a) input signal; b) sampling points; c) result of sampling procedure.

Very low level signals give a stepped transfer characteristic. Adding dither input in increasing amounts linearises the transfer characteristics.

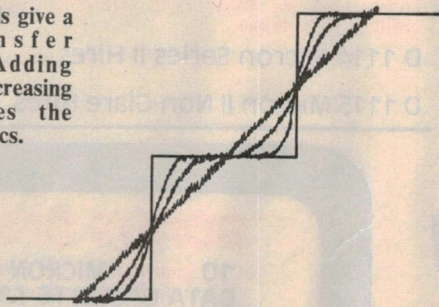


Fig. 2

**Acknowledgement:** These diagrams have been redrawn from the paper by Vanderkooy and Lipshitz, mentioned in the text.

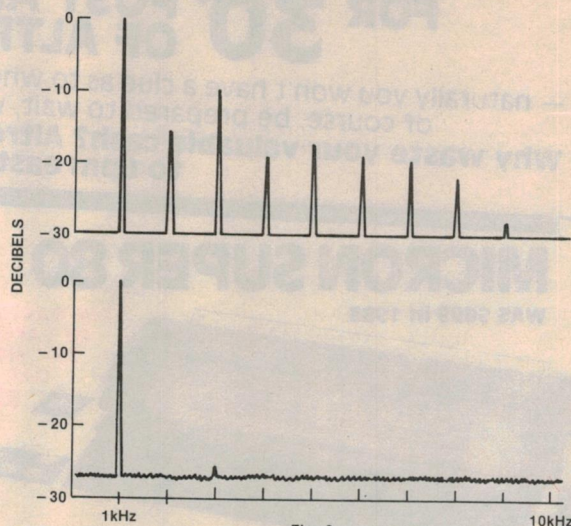


Fig. 3

**Top:** Gross harmonic distortion results from the quantisation of low level tones. Here, third harmonic distortion is about 30%. **Bottom:** Adding dither noise at around -27dB to fundamental (still at very low level) pushes the distortion down into the noise.

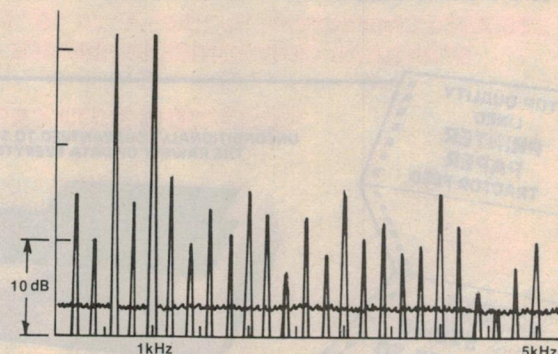


Fig. 4

**Intermodulation:** The large spiky trace shows intermodulation components when a low-level double tone is quantised. The low level trace shows that these components are submerged into noise when dither is added.

A truly non-dithered tone recording would have to be sourced from a completely noise-free audio generator and A/D converter, or directly from a computer producing the requisite numeric pattern. As such, it would be non-typical of music.

Normal program material is virtually certain to be accompanied by continuous low-level background noise, be it acoustic in origin (air conditioning, etc) or to do with the recording chain. It may or may not be broadband noise, it may be too much or too little but it is likely to provide the wanted signal with some degree of self-dither and improved low-amplitude linearity.

Vanderkooy and Lipshitz say that, whereas 12-bit and 14-bit systems commonly need added dither, the LSB in a 16-bit system is so small that natural analog noise ahead of the A/D converter is likely to provide adequate dithering. It is not something that should be left to chance, however, or to subjective judgment. For optimum results, means should be available to evaluate and manipulate both the quality and the quantity of the dither.

One final word: after all that's been said, it might seem that dither noise is of overwhelming importance; something on which the whole validity of digital recording and playback depends.

That would be a gross exaggeration.

Dither noise (I prefer dither "bias") is a refinement which extends the capacity of the digital system to cope with very small amplitude signals and, from a purist viewpoint, that has to be a good thing. But whether its effect is subjectively evident under normal listening conditions is another matter.

Aging ears and the limited dynamic range imposed by suburban living may be such that you'll never hear what we've been talking about. On the other hand, if you are keen-eared you may well hear what sounds like tape hiss in behind records which are supposedly digitally mastered. That noise is "dither".



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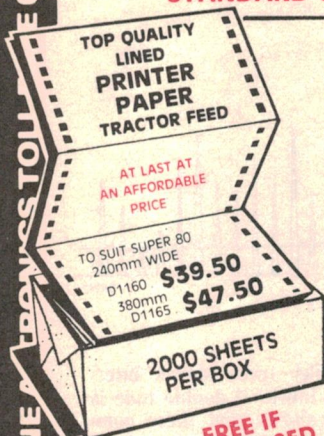
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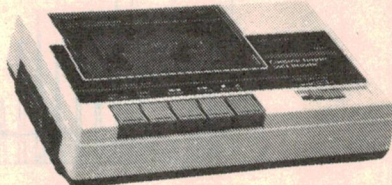
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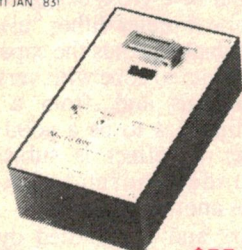
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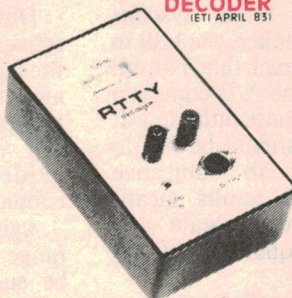


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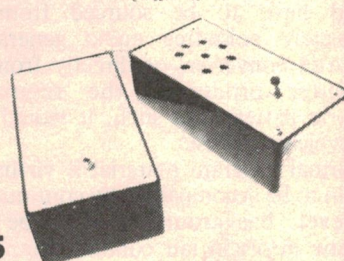
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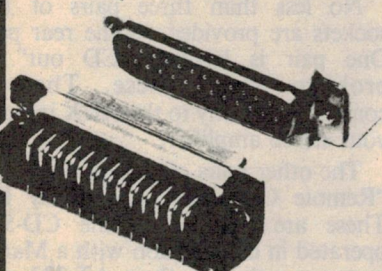


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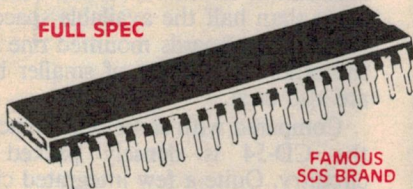
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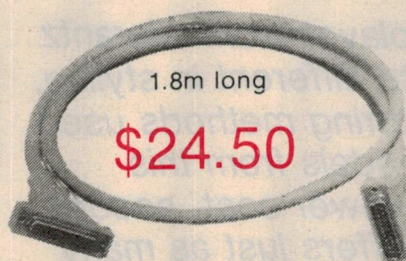


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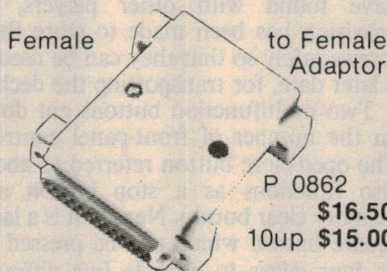


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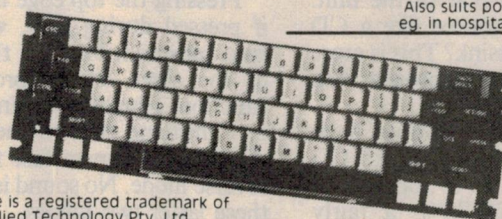


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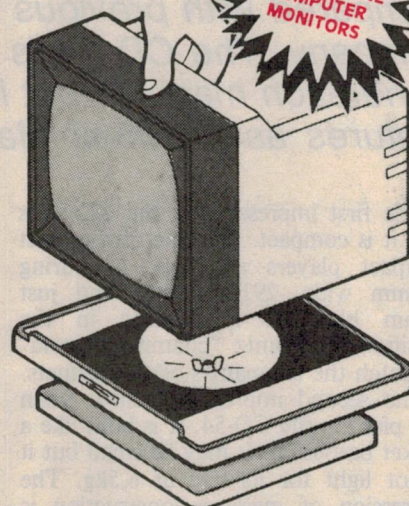


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# *Electronics Australia reviews the* **MARANTZ CD-54** **compact disc player**

*The latest compact disc player from Marantz is the CD-54 which is quite different in styling, presentation and manufacturing methods used compared with previous models from this company. The CD-54 is a lower-cost, second generation machine but it offers just as many features as previous Marantz CD players.*

The first impression of the CD-54 is that it is compact. It is one of the most compact players available, measuring 320mm wide, 291mm deep and just 90mm high. It is finished in the traditional Marantz "champagne gold" to match the company's other products.

The second impression comes when you pick up the CD-54. It is built like a pocket battleship. It may be small but it is not light for its size at 6.5kg. The impression of massive construction is reinforced by the presence of a heavily finned heatsink at the rear of the unit. Why should a signal source like a CD player need such a heatsink? This is more evidence of the different approach with this new model from Marantz.

Two methods of disc loading have been employed by other Marantz CD models. The CD-63 is a top-loading machine while the CD-73 is a fairly complicated front-loading machine in which the whole player mechanism slides out. The CD-54 is simpler and adopts the now popular front loading drawer system.

The drawer system has to be commended as the easiest to use. Just press the open/close button and the drawer slides out, ready to receive the disc. The user can drop the disc onto the drawer without any need to locate it precisely and, in doing so, the user can hold the disc without putting fingers all over the mirror-finished recording side.

As with all other compact disc players, the CD-54 has a number of transport locking screws which must be removed

before the unit can be played. As we have found with other players, no provision has been made to store these screws safely so that they can be used at a later date, for transporting the deck.

Two multifunction buttons cut down on the number of front-panel controls. The open-close button referred to above also functions as a stop button and memory clear button. Next to it is a large square button which can be pressed on its four edges to provide five different functions.

Pressing the top edge initiates play or, if pressed during play, will skip to the next selection. Pressing the bottom edge of the same button provides a pause function. Finally, pressing the left-hand or right-hand edge of the button moves the laser pickup in fast forward or fast reverse mode. No sound is audible during these latter two modes.

Five small buttons are strung out on the right-hand side of the control panel. Four of these provide for the storing of up to 24 selections and playback in any order. The fifth button is labelled "remain/lap" and, when pressed, brings up the time remaining on the three digit display.

Both the three-digit display and the 24-bar track number selector are comfortably bright without being obtrusive. When a disc is loaded into the machine, the laser reads the playing time and the number of selections is displayed. If a disc with more than 24 selections is to be played an error light briefly illuminates and then goes out.

No less than three pairs of RCA sockets are provided on the rear panel. One pair is labelled "CD out". No problem about these. They are connected directly to the AUX inputs on your stereo amplifier.

The other pairs of sockets are labelled "Remote Cont Bus" and "Easy Bus". These are used when the CD-54 is operated in conjunction with a Marantz system employing their AT-333 audio timer and RMC-10 remote controller.

A removable two-core flex is fitted to the CD-54, which is double-insulated. Power consumption is rated at 32 watts.

The reason for the relatively high mass of the CD-54 becomes evident when the top and bottom covers are removed. The unit has a surprisingly massive diecast chassis. This is divided by deep box-like sections which separately house the transformer, the laser tracking mechanism and, in a section occupying more than half the available space, two large circuit boards mounted one above the other. A number of smaller boards are also used.

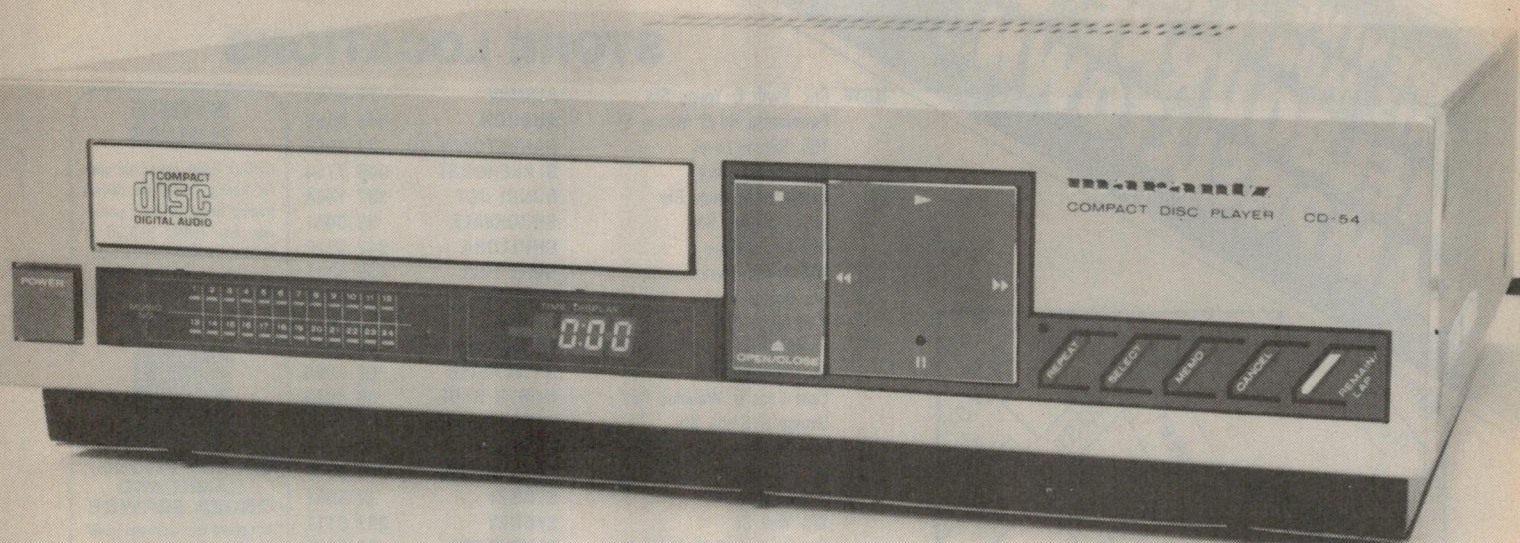
Compared with some other machines, the CD-54 is densely packed with circuitry. Quite a few integrated circuits are employed together with numerous discrete transistors and passive components. That rear heatsink referred to earlier accommodates four three-terminal regulators which provide stabilised supply rails within the unit.

While some manufacturers appear to have invested heavily in new tooling in order to reduce manufacturing costs, Marantz apparently has not taken this path with its new second-generation machine. It certainly has invested heavily in tooling but the CD-54 does not seem to be an inexpensive machine to produce.

Another interesting point is that while previous Marantz CD players were made in Belgium, the CD-54 is made in Japan.

Marantz has an unusual "swing balance" tracking mechanism which moves the pickup in an arc across the





disc surface. This swing balance feature is claimed to give "excellent anti-vibration characteristics and immunity against oblique setting".

### Specifications

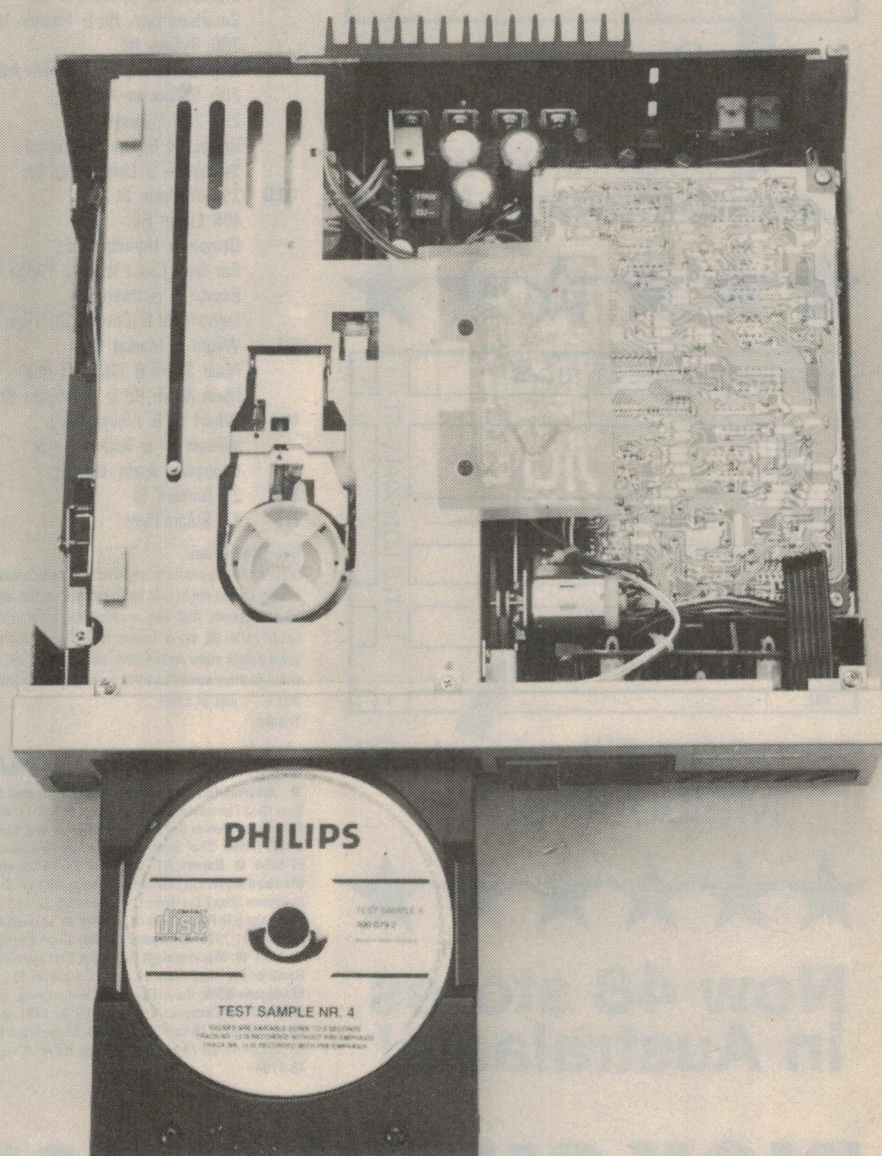
Specifications of the CD-54 are quite conservative and on the vague side. Frequency response is quoted as 3Hz to 20kHz with no amplitude limits. Dynamic range is 90dB or greater and total harmonic distortion is quoted at .003% without any reference frequency or signal level being noted. Similarly, channel separation is quoted as 90dB or greater, without note of signal frequency.

An interesting point which arises from reading the spec sheet is that the CD-54 uses 16-bit digital-to-analog conversion with digital filtering. This is quite a different approach to previous Marantz practice, which used 14-bit D/A conversion and four-times oversampling with high order analog filtering.

On the other hand, the error correction system is the same as on other Marantz models: Cross Interleave Reed Solomon Code (CIRC).

For most of the technical measurements we used the Technics test disc in conjunction with our Sound Technology automatic nulling distortion bridge plus a dual channel oscilloscope. Verifying CD performance in this way is much easier than the comparable tests on a turntable plus cartridge or a stereo cassette deck.

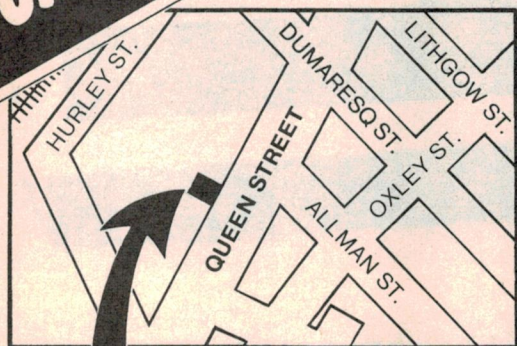
With a CD player the process is very straightforward. There are no fiddly adjustments to be made and one does not have to repeat the tests ad nauseam as is required to characterise the performance of a cassette deck fully. Still, the measurements have to be made with a



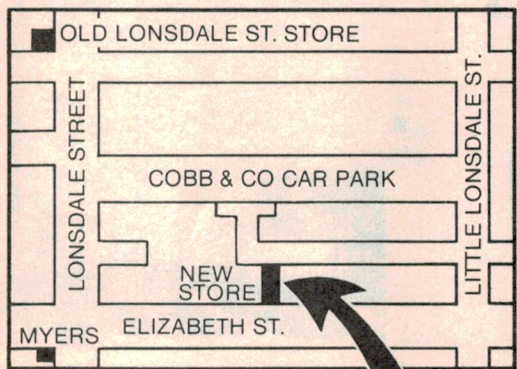
An inside view of the Marantz CD-54, with disc drawer extended.



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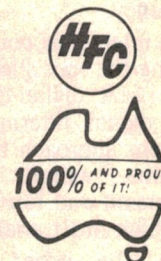
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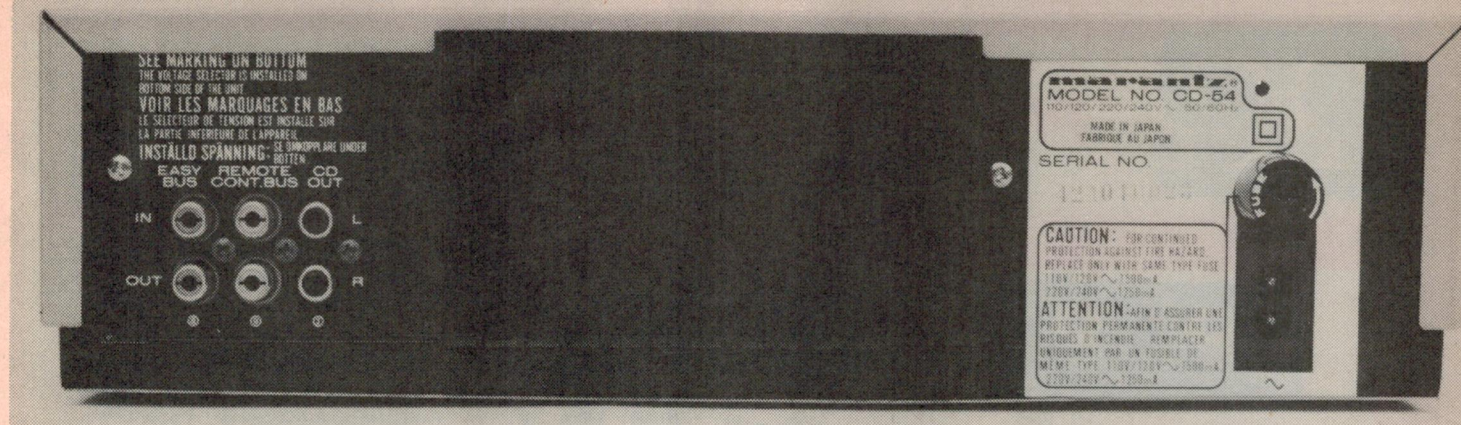
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The rear of the CD-54 has three pairs of phono sockets. Note that it is double-insulated.

## MARANTZ CD-54 compact disc player

high order of precision; such is the level of CD performance.

The first test to be performed is that of linearity. This uses a 1kHz tone which is stepped down in level in 10dB steps to minus 90dB. The idea is to check how the output signal level changes in line with the recorded levels. Most CD players are pretty good in this respect until they get below -60dB. At this point, the Marantz shows up well. It had a 1dB discrepancy at -70dB and a 0.5dB discrepancy at -80dB.

Frequency response tests were very good. Most decks are rated from 20Hz to 20kHz within  $\pm 0.5$ dB. In practice they are usually about 1dB down at 20kHz with respect to the level at 1kHz. The CD-54, on the other hand, was absolutely flat over most of the range and was only 0.5dB down at 20kHz.

Worrying about 0.5dB or 1dB rolloffs at 20kHz may seem unnecessarily picky but some overseas "golden-eared" reviewers have claimed to be able to hear subtle differences between different models of CD players. Engineers have theorised that these differences, if really perceived, may be due to small ripples in the frequency response of the machines.

Whatever the theory we can say that the Marantz CD-54 is the flattest machine we have tested so far.

It must also rate amongst the quietest with a measured signal-to-noise ratio just in excess of 100dB — which is quiet. At this level of performance, noise from the following stereo amplifier is likely to predominate.

When measuring total harmonic distortion we ran into a problem. We found a residual signal which is probably an artefact of the D/A conversion process, which was about -50dB with respect to 0dB reference level.

This effectively prevents any reading lower than about 0.3% being registered in a total harmonic distortion

measurement. Interposing a third order active filter in the measurement chain did improve matters but we could only resolve down to about .015%. It was clear that harmonic distortion was considerably lower than this figure.

Such a residual signal, which is at a low level and in the region of 30kHz to 40kHz or higher (we were unable to measure it), is clearly inaudible and will have no effect on the sound reproduction.

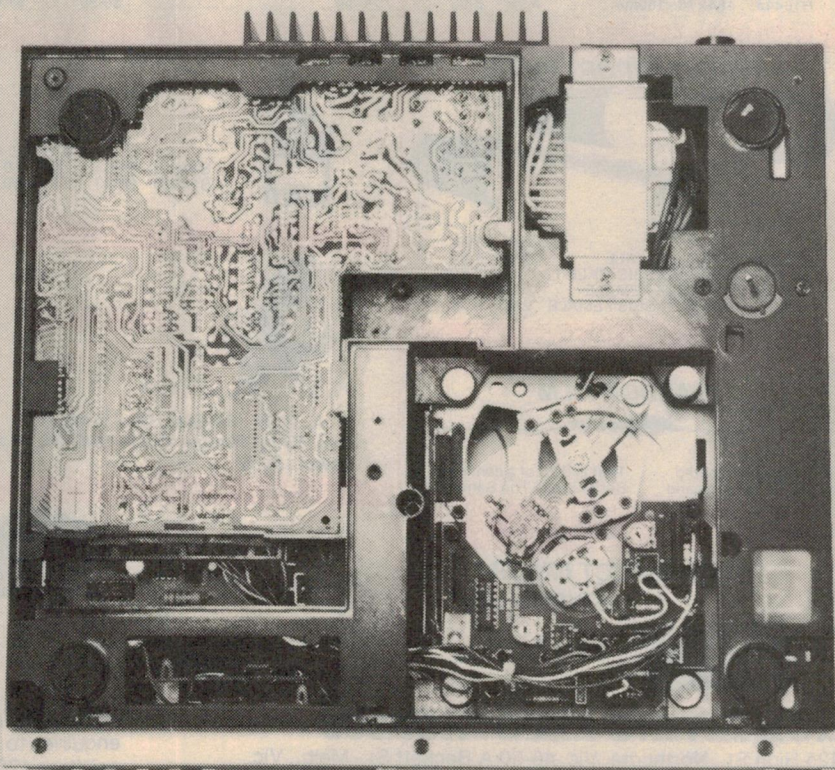
Separation between channels was easily measured and resulted in readings of -90dB at 100Hz; -99dB at 1kHz; -94dB at 10kHz; and -88dB at 20kHz.

This substantially confirms the 90dB specifications quoted above.

We also tested the CD-54's handling of defects using the Philips No. 4A test disc. This was another boring experience as the player sailed through the whole 56 minute selection of tracks without so much as a single audible hiccup. Mind you, not all CD players can do this.

Vibration resistance was tested in a less objective way. We variously bumped, jolted and rapped the player to get it to mistrack. Again, while it was possible to upset it and make it jump forward or backwards by about a second

*Continued on page 136*



This underside view of the CD-54 shows the "swing balance" laser mechanism.

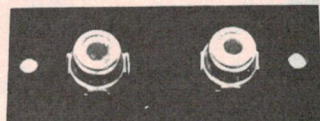




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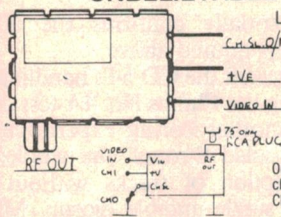
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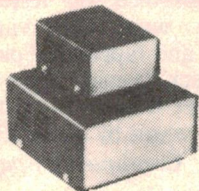
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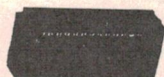
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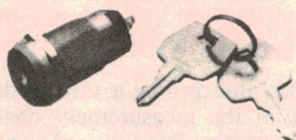
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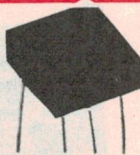
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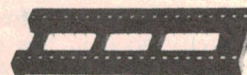


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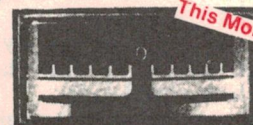
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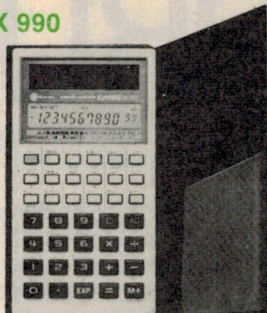




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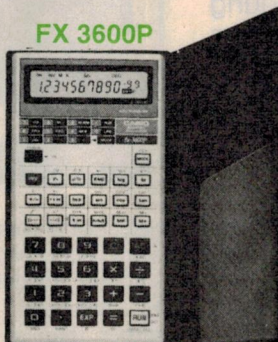


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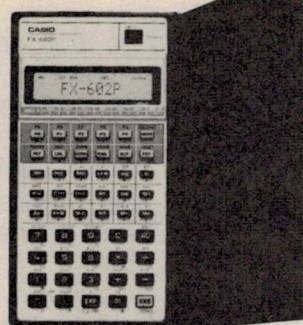
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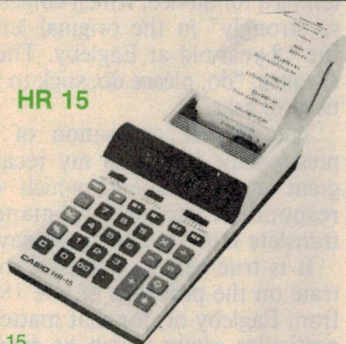
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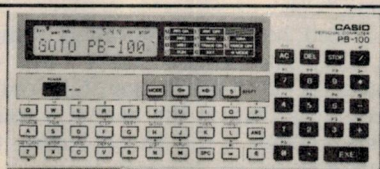
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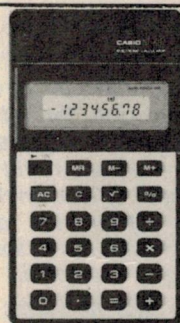


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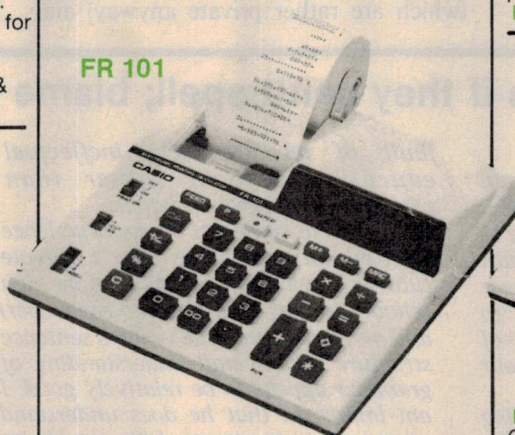


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# An impossible dream — from a coun

Readers reacted to our article in the April issue under the heading "From a young reader: what do you do when you can't find a job?" By telephone and by letter some have supported our observations, some have criticised them, and others have sought to share their own ideas and experience.



## FORUM

Conducted by Neville Williams

Readers' remarks, made on the telephone, are difficult to crystallise but many obviously share the view that, if a young person is to get anywhere in life, they must display interest, integrity, initiative and a willingness to get on with the job in hand. At a personal level, they need to be seen as clean and tidy, rather than grubby and careless — the "old-fashioned values" which we commended in the April issue.

One reader put it his way: "Your Forum, this month, was right on the ball. It should be required reading for every young person seeking a position."

Expressing a quite different view, the most trenchant criticism comes in the form of a letter from a reader in Kelvin Grove, Queensland.

After indicating what he didn't like about my observations, the writer launches into an attack on the Queensland education system, detailing its impact on his own family by way of illustration. If the young reader from our April issue has a writing/spelling problem, he says, blame the system, not him!

He suggests that electronic component suppliers could do with people behind the counter (eg the young reader from Eagleby) who are interested in the customer's need rather than in simply making a sale. He relates examples of how he has been given the run-around in some electronics stores but adds: "I must stress that similar experiences have confronted me with other companies, where retail sales, not good customer relations, have been the name of the game."

Indeed, he says, the prevailing attitude in electronic supply stores "has encouraged me to spend more time out of electronics than in the hobby in recent years, though I still go on buying the magazines for some reason."

At that stage, he appears to have realised that the letter was quite long and that, as a result, it would probably not be published. But it's a shame to waste so much dissident dissertation and we reduced the letter to manageable proportions by omitting references to family (which are rather private anyway) and

the recital of his shopping adventures (really another subject). What remains — his central theme — is set out in a separate panel. I suggest you read it at this juncture.

As you will note, I stand accused of obtuseness, which I would take to mean: **"not sensitive or observant; stupid; dull in perception, feeling or intellect."**

From another reference in the letter, I assume that this has mainly to do with my failure to concentrate on the "unwritten plea for advice, which comes through so strongly" in the original letter from the 18-year-old at Eagleby. There's also the plea: "do, please do, stick to the question he asks."

The further accusation of "waffle" presumably relates to my recall of the great depression era, which our correspondent somehow manages to translate into "the good old days".

It is true that I chose not to concentrate on the problems of one 18-year-old from Eagleby or, for that matter, on the particular group which he represents. I saw it rather as an opportunity to talk

## Don't blame the kids if they can't spell; blame the system!

Dear Sir,

Your response to the letter from an 18-year-old at Eagleby has caused me a range of emotions... from annoyance to agreeable acknowledgement of the truth of what you have written, to sheer frustration at obtuseness and on to downright amazement at the extent of the "waffle" in some parts of your column.

I could spend several hours responding to your responses but it would probably serve little purpose. Instead, I will raise a few points which, to me, seem pertinent to the matters raised by our friend from Eagleby.

Your point on carelessness leading to mis-spellings: in the education system we idiot Queenslanders have to accept, I doubt that there would be too many recent high-school graduates who would be capable of seeing the spelling errors in the letter you published. That is more the

fault of an extremely ineffectual education system, rather than carelessness or slovenly habits.

I base that comment on my experience with education (I have been a private tutor in English and maths to more high school students than I care to remember) and on the fact that the writer's sentence structure and overall understanding of grammar appear to be relatively good. I am impressed that he does understand what he is trying to say, I like the choice of structure in both sentences and letter, I thoroughly approve of the respectful and "non-grovvelling" tone, etc.

Frankly, this kid strikes me as one who has a damn good idea of what he is about — what a shame that his high school training has not given him a better command of spelling. Don't discount him because his spelling and punctuation are off. And don't make such inept and unwarranted leaps from one fact to a con-

clusion which simply can't be supported by the minimal facts you cite.

Now where in the letter, or in the unwritten plea for advice which comes through so strongly to me, has he asked you or anyone to fill in the information you have offered on the "good old days"? That information does not hold as background in the sort of situation he is trying to overcome.

He says he wants a job in the sales field of electronics; believes that a background in the hobby of electronics probably should serve him well in obtaining such a position. Why shouldn't such a background do nicely? If he wants to sell electronic components and knows a transistor from a transformer then he should have very little trouble picking up the rudiments of selling rather swiftly.

There is a point here which both you and the writer have overlooked, though



# ter hand to managing director?

about — and promote debate on — the future of all the young people numbered amongst EA readers, who may be aspiring to a job in any aspect of the electronics industry.

The idea for such a debate came from the original letter but the decision to broaden its scope was stated quite clearly in paragraph two of the April "Forum":

**"It may be more helpful to discuss job opportunities generally in the electronics industry."**

What followed, I suggest, was consistent with that objective, including much of what has been dismissed by our critic as obtuseness and waffle.

I guess it's a matter of opinion.

Unfortunately, complaints about the education system are not unique to Queensland. Prompted by this latest correspondence, we showed the letter in the April issue to an English subject mistress from a Sydney high school, posing the question:

"Would many of your recent graduates be capable of picking out the spelling and other errors in that letter?"

She read it through, considered a while and replied:

"My better students would certainly pick up some of the errors but average students would probably read it through without noticing much wrong with it."

"Are you happy with such a standard?"

"No I'm not but what can you expect

when the kids have been told for 10 years that grammar and spelling don't matter all that much?"

"Are they still being told that?"

"Fortunately, no. I point out to my students that English is the one and only compulsory subject for the HSC; furthermore that a facility in English is virtually essential for the pursuit of a whole range of other studies!"

"Could that be just a personal point of view?"

"I don't believe so, as evidenced by suggestions from Sydney University that they might require a higher achievement in English before admission to a range of other courses."

"Would you say that the 18-year-old from Eagleby is about average in his writing ability?"

"I'd say that he's above average, as matters now stand. He knows what he wants to say — but he does show signs of carelessness!"

That last remark was quite spontaneous and in line with my own observations in the April issue, culminating in a warning to young people generally against any hint of carelessness, especially in a job application. Whether or not it applies to the young man in question, the advice will hopefully not be wasted on others.

I read the last paragraph in the Kelvin Grove letter several times without experiencing either heat or light: I **must** not question a young man's desires but I **can** point out that he is talking about a job that offers little opportunity for advancement. I'm reminded of one of my late grandmother's standard funnies: "You can go for a swim but you mustn't go near the water!"

In fact, I rounded off the April instalment by asking very deliberate questions about on-going training in the sales/commercial/management area, as distinct from technical courses:

*"What incentive or what opportunity is there for sales staff to pursue a course in advertising, marketing or management? What next step would be open to our young reader if he did manage to get the kind of job which he seeks? Consider the subject open for discussion."*

That question and invitation prompted a number of responses, including two letters in particular, which we reproduce. When you've read them, you'll understand how we came by the heading to this present article: "An impossible dream...?" The first letter comes from Mr Ike Bain, Managing Director of Dick Smith Electronics Pty Ltd. He says:

Dear Neville,

RE: "What do you do when you can't find a job?"

Your reply to the young Queensland reader was excellent and raised some very relevant points.

You ask what "next step" would be open to our young reader if he did manage to get the kind of job he seeks.

Too many people think that the only future in electronics is in the technical area; NOT SO. I can say from experience that, during my employment with DSE since 1972, I have seen hundreds of people begin their careers here at around the age of our young reader and, with only hobbyist knowledge, later become store managers, technicians, buyers, marketers and computer programmers.

Not only that but some of them have even started their own electronic business: Tekav, Jaysmith, etc! Even I was lucky enough to start out with DSE as a technician at 20 years of age, became a "counter jumper" and ended up as Managing Director. All our staff have the potential to become highly paid magement and I'm sure that this doesn't happen only at DSE.

Personally, I would employ an electronics enthusiast over a car salesman any day!

Ike Bain (Managing Director),  
Dick Smith Electronics Pty Ltd.

In a subsequent conversation about the contents of the letter, Ike Bain said that he had written it because he felt concerned for young people such as the 18-year-old from Eagleby. He wanted to encourage them and help them, if possible.

I took the opportunity to ask a few questions:

"How had he personally managed to make it from a counter hand to Managing Director? There was more to it surely than simply being in the right place at the right time and letting promotion happen?"

"There certainly was", he replied, "and it involved a lot of hard work. But doesn't everything that's worthwhile?"

Ike Bain said that he had done a course in basic electronics in Canada and had also gained his amateur licence. It was while shopping around for amateur gear, after arriving in Australia, that he visited Dick Smith's Atchison Street store and met the rather harassed proprietor. He passed a remark that "the place could do with more effective stock control" and, on the strength of that observation, accepted a job on a trial basis for three weeks, to reorganise the amateur section.

*he does hedge around it a little in his scathing comment about "professional sales people trained in all the tricks of optional extras". I personally have been the victim of such people.*

*Frankly, Mr Williams, I would rather have a young man behind the counter serving my needs with a knowledgeable background in electronics rather than an inadequate training in either sales or electronics. The young man from Eagleby may well be a better bet in my view.*

*If he wants a job in electronics writing, he would have enquired about that field. If the field of electronics retailing seems a dead end to you, then who are you to query the young man's desires? Certainly bring to his attention that he is talking about a job opportunity that offers little in the way of further advancement but do, please do, stick to the question he asks.*

*(From Kelvin Grove, Qld).*



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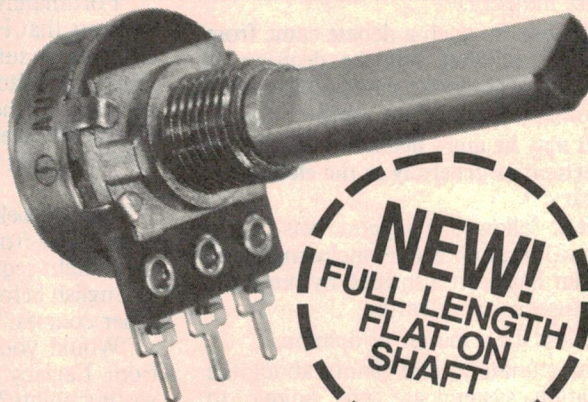
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The three weeks has grown into 14 years, and the job of reorganising a department into one of managing the entire operation. Ike Bain confesses to attending a few management symposia but, for his progress in the company, he attaches most of the credit to learning by doing — "something that assumes a willingness to learn!"

On-the-job training comes through strongly in his ideas about DSE staff generally.

Ike Bain is in no sense against formal training, particularly formal technical training. But, he says, if a person understands all about components, what they are and how they work, it's unlikely that he'll finish up behind a counter selling them. He'll be snapped up and paid and promoted as a technician or engineer... "and believe me, there aren't enough of them in Australia to go around."

Dick Smith Electronics needs technically trained staff for key positions but it also needs technically informed hobbyists to recruit, train and promote in the areas of sales, administration, management and so on. Says Ike Bain:

"We are always on the lookout for keen electronic hobbyists with the right attitude, but they're hard to find. There's simply not enough of them around, either. We run vacancy adverts in a time of supposedly high unemployment and end up with two or three replies! Where are all these keen hobbyists?"

"What did you mean by hobbyists 'with the right attitude'?"

"The sort of thing you talked about in the April issue: interest, enthusiasm, commitment, tidiness, a willingness to be courteous..."

"You mean those old-fashioned values?"

"Exactly. Unless staff exhibit those qualities, we can't run the kind of stores that customers say they want."

This is only a summary of the total conversation but the thing that came through was that opportunities do exist in electronics retailing for young people like the 18-year-old from Eagleby, with a workable knowledge of — and a hobby interest in — electronics. But, to make the best of those opportunities:

- Applicants should present themselves — and strive to become — the kind of person that company executives say they need.

- They should apply by neat, formal letter to the manager of selected companies, enclosing a personal reference. A well presented letter is likely to remain available, on file. Job inquiries over the counter or by telephone are too easily ig-

## "On the lookout for bright young people"

Dear Neville,

I read with interest the letter published in April "Forum" and your comments.

Whilst I agree whole-heartedly with your response to the correspondent, I thought I could perhaps add a few words from a typical "Jaysmith".

Firstly, notwithstanding punctuation, spelling errors, etc, I was impressed by the initiative taken by your Eagleby correspondent. We receive job application letters similar to that published but, alas, only rarely. On such occasions, the applicant is given serious consideration, even if there are no openings at the time. Such is the power of written correspondence!

I agree with your comments regarding neatness and hygiene. Far too many young people seem to think they are not important. I fear that this is due to the relaxed standards of dress (including teachers) in state high schools. It is difficult to blame young people if they have not had the importance of neatness and hygiene impressed upon them — especially in relation to job interviews.

It is understandable that you have emphasised formal training as a way

to improve job prospects. Frankly, however, we find that very few of our staff actually complete formal technical electronics training. Whilst training is important, the retailing industry requires other skills; Jaycar provides training in sales and management for its staff.

Nevertheless, when we interview staff for our showrooms, we test the applicant for electronics knowledge. The applicant must demonstrate a sound knowledge of electronics, even at a hobby level, before he is questioned over other criteria. Previous sales experience is a help but not essential.

Quite frankly, a well presented person (not necessarily male and young) with a sound electronic knowledge and an outgoing personality has a good chance for a job. It is almost that simple.

We, like many of our competitors, are always on the lookout for bright young people to work for us. Any person who is genuinely interested in a technical sales career is welcome to write to our company.

Gary Johnston (Managing Director),  
Jaycar Pty Ltd.

nored or forgotten.

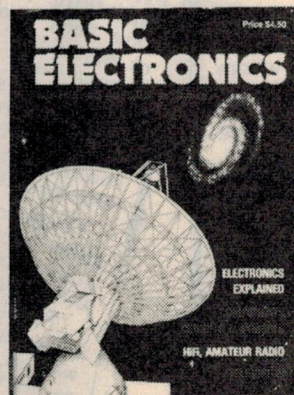
If these statements need further support, I suggest that you read the second letter, from Mr Gary Johnston, Managing Director of Jaycar Pty Ltd, another very active vendor of electronics parts and kits. Lack of space prevents me from recounting Gary's further observations but, really, it doesn't matter. His letter

says it all.

But, then, I wonder whether they've made it sound too easy? Or is there really a shortage out there of employable electronic hobbyists?

FOOTNOTE: Other letters on this subject, including one from the Commonwealth Employment Service, have had to be held over to a later issue. ☺

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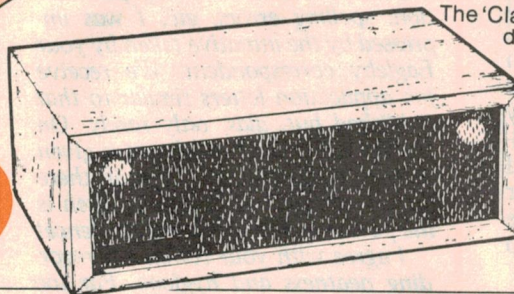
It is used by radio clubs, in secondary schools and colleges, and in WIA youth radio clubs. Begins with the electron, introduces and explains components and circuit concepts, details the construction of simple receivers. Separate chapters on test instruments, servicing amateur radio, audio techniques, stereo sound reproduction.

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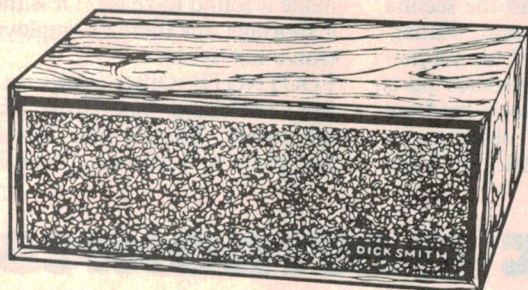


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**INNOCENT VICTIMS OF BURGLARIES 'VIOLATED'**

**VICTIMS of burglaries feel violated when their home has been ransacked, according to a psychologist.**

**By PAM LESMOND**

"They feel as though their home is no longer their castle - it's extremely upsetting, especially if things have been overturned or messed up," Dr Lyn Barrow said.

Dr Barrow said if the victim suffers another burglary they can become extremely nervous and frightened.

Dr Barrow said burglary victims suffer from enormous stress after repeated attacks. "People living alone, especially elderly women, are prone to severe stress."

He said some people become too scared to leave their homes because they fear it will be ransacked.

"I think we should be looking at the reasons why people need to steal rather than imposing harsh sentences," Dr Barrow said.

Another psychologist, Dr Robert Spillane, said people rarely believe they will fall victim to a burglary attack.

'The Sun'  
 9th May, 1984



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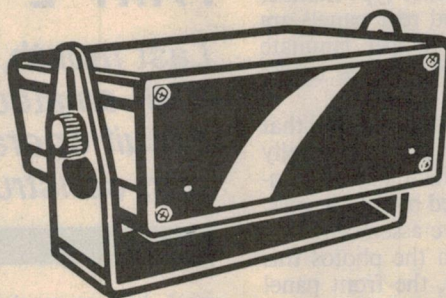
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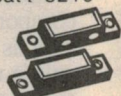
**\$34.95**

Cat L-5280

### Reed Switch/Magnet Set

Mounted so the magnet holds the switch closed, if the door is opened, switch opens. Attaches to most alarm systems.

Cat L-5210



**\$2.75**

### Earsplitter

Scare the pants of them with this high efficiency horn speaker.

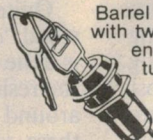
**\$10.25**



Cat C-2705

### Barrel Key Switch

Barrel type key switch with two keys, used at entry-exit point for turning the alarm system on-off.



**\$7.25**

Cat L-5290

### WARNING STICKER



**\$1.00**

Cat L-5310

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Most alarms have provision for a fire sensor. Take advantage of it and protect your home and property! Use any number of sensors in likely 'hot spots'.

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**DICK SMITH ELECTRONICS**



See page 30 for full address details



While the circuit of the new VHF transceiver is relatively complex, its construction is reasonably simple and does not require any special assembly techniques. A soldering iron and a screwdriver are virtually all you need. Make sure the iron has a small chisel-shaped bit, for quick and effective soldering.

Most of the circuit components, with the exception of front panel and rear panel hardware, are accommodated on a single-sided printed circuit board (PCB) measuring 162 x 199mm and coded with the Dick Smith Electronics type number ZA1687. The front and rear panels are also made from PCB copper laminate and are soldered at right angles to the main PCB.

The whole PCB assembly fits (and that is the operative word) into a specially designed ABS case which has two interlocking halves secured by four screws. It is a neat and effective assembly.

As can be seen from the photos this month and last month, the front panel has white silk-screened labelling on a black background. This is combined with an attractive set of knobs and other hardware plus a backlit signal/power meter to produce a professional looking transceiver which is every bit as good as expensive commercial units.

### Construction aids

All purchasers of this transceiver kit will receive a detailed assembly manual which describes construction on a step-by-step basis. The parts layout diagram comes complete with a grid pattern and you simply insert each part in turn at the grid location and cross it off the parts list.

In addition, the main PCB will be supplied with a screen-printed overlay as published on page 47 of this article (our prototype unit did not have this overlay). The copper side of the board also has a solder mask to reduce the possibility of solder bridges. Finally, to help construction you can use the colour photos in last month's issue as a guide although note that kit versions will differ slightly from our prototype.

### Board preparation

Before actually mounting any of the components, a certain amount of work on the PCB is necessary. The first job is to remove a 3mm strip of solder mask from the earth pattern at either end of the PCB. This is best done by masking off each 3mm strip with masking tape and then removing the solder mask using a cotton bud dipped in nail polish remover.

Alternatively, the solder mask can be scraped off using a sharp utility knife.

Constructors should also inspect the board very closely to see if the solder

# VHF amateur transceiver

## PART 2

by LEO SIMPSON

*Last month, we introduced the Commander VHF amateur transceiver and described its circuit operation. This month we conclude with construction and alignment of the unit.*

mask has encroached onto any of the mounting holes of the components. Check also that all component holes have in fact been drilled and that there is no evidence of bridging in the copper pattern. None of these faults may in fact be present but it is better to spot them now rather than try and find them when most of the soldering is complete.

It may also be necessary to slightly enlarge the mounting hole for power transistor Q22. This transistor is mounted and soldered on the underside of the PCB and secured by a stud which passes through the board.

Q22 requires a clearance hole of 10mm so that its seating plane can pass right through the PCB and butt up to the aluminium heatsink. More on that later.

### PCB assembly

We are now ready to commence assembly of the PCB. Begin by installing the PC stakes and wire links. The wiring diagram on page 48 indicates where most are required. Additionally, PC pins are required as a foundation (4) for the oscillator enclosure and as locating points for the front and rear panels.

The four PC pins for the oscillator enclosure and earth pin for Q21 should be fitted from the copper side of the PCB so that the longest end is through the PCB.

The use of PC pins for the external wiring is optional but we recommend it. PC stakes make it so much easier to disconnect and re-connect wires if that becomes necessary.

There are 13 wire links on the PCB and all except one of these are labelled "LK" on the overlay diagram. The exception is near C158. These two are shown but not labelled on our diagram.

In addition, note that one of the links should be insulated (near D33).

With the job of installing the PC stakes and wire links complete, there is now the longer task of installing all the resistors and capacitors. This is where the colour photo of the interior published last month will come in handy. You can use it to cross-check that your resistor colour codes are correct.

### Keep those leads short

The most important point to remember when installing all these small components is that the pigtailed should be kept as small as possible. Because the circuit is working at very high frequencies, any long component pigtailed will act as unwanted inductors and play merry hell with the performance.

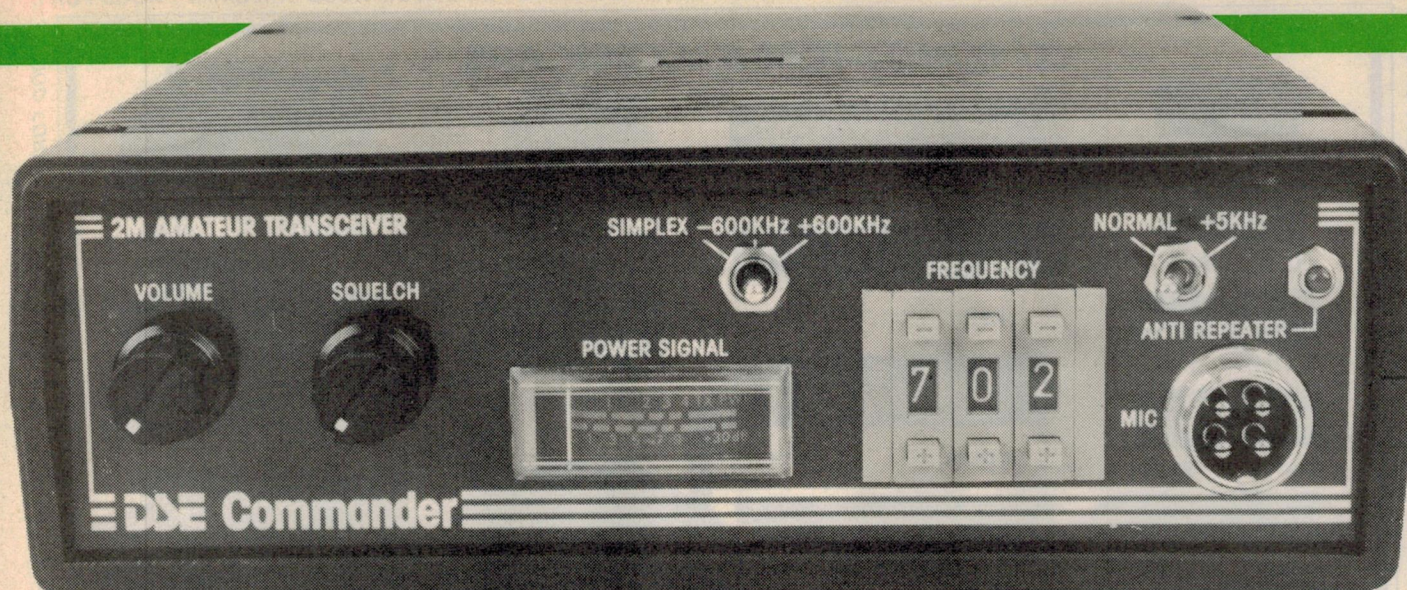
Quite a few of the resistors have to be stood "on end" to fit them in. When this is done the clearance between the end of the resistor body and the PCB should be around 1mm. It is a good idea to install these vertical resistors with the colour code running down the body. It is easier to check the resistor values in this way.

R111 (100kΩ) should not be installed before FL3 and Q8 are inserted and soldered. It loops over these two components.

Little comment is required with regard to mounting the capacitors except that you must use the capacitor type specified. There are no ifs or buts here. Do not interchange greencaps (ie, metallised polyester) for ceramics or tantalums for normal electrolytics (or vice versa).

C169 is a couple of light duty insulated wires twisted together. The amount of twist is adjusted (sounds very precise,





doesn't it?) during the calibration procedure.

## Semiconductors

The semiconductor complement is 33 diodes, 30 transistors and seven integrated circuits. With the total at over 70, it might seem a lot but don't hurry the task to get through it quickly.

Mount the diodes first and again the pigtailed should be kept as short as possible but take particular care with the diodes that are mounted "on end". Make sure that the polarity is correct.

Without wishing to labour the point, make absolutely sure about the polarity of diodes mounted "end-on". Remember that once you have soldered and clipped the leads you will not be able to re-use the diode if you find it has been installed the wrong way around.

Pay particular attention when installing diodes D22, D23, D24 and D25. The cathode end of these diodes is indicated by the red band. The yellow and orange bands make up the colour which indicates the 243 type number (ie, red, yellow, orange).

D14 is installed with cathode end up and anode to PCB earth. It is part of the pickup (including "gimmick" capacitor C169) for the meter circuit.

Care is also required when mounting the transistors to ensure correct lead orientation. Double check each transistor against the circuit diagram before soldering it into circuit. All the small signal plastic pack transistors, plus the metal encapsulated TO-18 types (Q6, Q7, Q17, Q25) should be mounted so that the transistor bodies are about 3mm above the surface of the PCB.

In practice, this simply involves pushing the transistors down onto the board as far as they will go without placing undue strain on the leads (and on your fingertips).

The TO-39 metal package transistors,

Q20 and Q21, are mounted flat against the PCB. The metal case of Q21 must also be earthed by soldering it to a PC pin which should already have been installed. Clip-on heatsinks are also fitted to Q20 and Q21.

As already mentioned at the start, Q22 is mounted on the copper side of the PCB. It has four brass tabs which are soldered directly to the PCB copper pattern. Make sure it is correctly oriented before soldering.

The integrated circuits require little comment apart from the two that are CMOS. These are IC2 and IC3, the decimal adders, 4560. These should be soldered while the iron has its barrel connected to the PCB earth pattern via a jumper lead. Solder pins 16 and 8 of IC2 and IC3 first, and then the remaining pins.

## Inductors

By now you are ready to begin installing the various RF transformers and coils. Ten of these have to be wound by you, the constructor. The necessary details of these are shown in the table on page 43 of this article. The main points to watch here are that you must use the correct gauge of wire for each coil and that the coils are wound exactly to specification.

Note that the hairpin coils L21 and L24 must be dimensioned exactly as called for in the table.

Coils L8 and L11 are supplied already wound and must be installed the right way around. If you closely examine the red plastic former of each coil you will notice that one side of the former has a long vertical rib while the other has a short vertical rib. In the case of L8, the long rib should be adjacent to L6. In the case of L11, the long rib should be closest to Q1, the BD140.

Assembly of the main PCB can now be completed by installing the filters, the

four crystals, and preset pots.

Finally, it is necessary to shield the VCO to prevent spurious radiation into adjacent circuitry. Supplied with each kit is a strip of double-sided PCB laminate which should be cut into four 28mm lengths. The four strips are then soldered to the PC pins at the corners of the VCO circuit.

## Final assembly

Attention can now be turned to the front and rear panels. These are supplied with the necessary cutouts for all the hardware and assembly is really very straightforward. For example, the frequency selector switch just clicks into place and has its own inbuilt retaining system.

Leave the heatsink assembly and meter off at this stage. Note that R37 (470Ω) is strung between the outside lugs of the volume and squelch pots, as depicted in the wiring diagram.

With the hardware fitted, slip the front and rear panels into their respective mounting slots in the case and mount the main PCB using the four self-tapping screws provided. The PC pins at the front and rear of the main PCB are now soldered to the end panels and the case fully assembled to make sure that everything fits.

Adjust the PCB assembly as necessary, then remove it from the case and run a series of solder fillets between the earth pattern of the main PCB and the end panels. This provides strength and rigidity.

With this done the rest of the assembly can be completed. Install the heatsink assembly for Q22, which comprises a short channel extrusion and a single-sided heatsink for the rear panel. These are secured using screws and nuts supplied with the kit. Finally, complete the wiring according to the diagram on page 48.







# VHF amateur transceiver

## Alignment

This is quite a straightforward process although you do need access to some test

equipment: (1) a digital multimeter; (2) a dummy load, eg, DSE cat D-7027; (3) a 5MHz (or better) oscilloscope; and (4) a digital frequency meter.

## Initial settings

- set the core of L18 flush with the top of the can;
- Set the core of L9 two turns down from the top of the can;
- Set the core of L10 one turn down from the top of the can;
- Set the slug of coils L8 and L11 one turn down from the top of the former;
- Set VR68 to  $\frac{1}{4}$  clockwise rotation.

## Voltage checks


























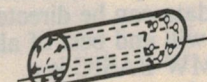
Connect the transceiver to a 13.8V DC power supply and make the following voltage checks:

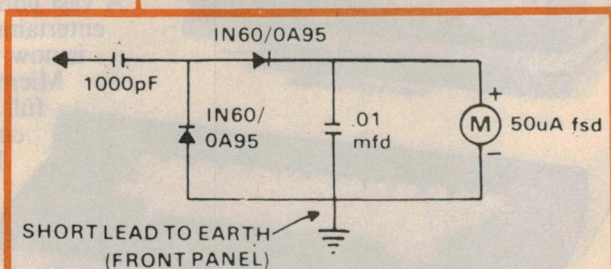
- Without switching on the unit, check that the input voltage is 13.8V DC. This voltage can easily be measured between the switch contact on the volume control and earth;
- Switch on (without microphone connected) and check for +10V DC at the collector of Q1 (allowable tolerance 0.5V);
- Check for +10V DC at the emitter of Q4 (allowable tolerance 0.5V).

## Synthesizer alignment

- Check TP1 (Test Point 1) for 10kHz clock frequency at 6V P-P (approx). Measurement for TP1 can be easily taken from under the PCB at Pin 7 of IC6.
- Check TP2 (output from L18 offset oscillator) for RF output. Use a sensitive RF probe or test probe as depicted in the diagram below.
- With oscilloscope on TP4 (mix down frequency), located at IC16, and the DC meter with the positive probe to TP3, adjust L8 (VCO coil) for 2.5—2.7V at 144MHz.
- TP4 should show a signal of 600kHz at approximately 2V P-P (simplex — 144MHz). (Minimum level of 1V P-P and maximum level of 2V P-P nominal).
- Adjust L18 (offset oscillator), for maximum amplitude at TP4.
- Select 147MHz. The DC volts at TP3 should increase to approximately 5 to 6 volts. The oscilloscope on TP4 will show a level greater than 1V P-P at 3.6MHz.
- Select 146MHz (simplex). Connect a dummy load to the output. The DC

## COIL WINDING DETAILS

L13	25 B&S En/Cu 1/8" (3.2mm) diam. close wound	4T			
L20 L30	18 B&S En/Cu 3/16" (4.7mm) diam. close wound	2½T			
L23 L25	18 B&S En/Cu 17/64" (6.7mm) diam. close wound	1½T			
L27 L28 L29	18 B&S En/Cu 17/64" (6.7mm) diam. close wound	2½T			
L22	18 B&S En/Cu 17/64" (6.7mm) diam.	1T			
L24	18 B&S En/Cu 1/4" (6.4mm) diam.	Hairpin			
L26	18 B&S En/Cu 3/8" (9.5mm) diam.	1T			
L21	25 B&S Tin/Cu 1/8" (3.2mm) diam.	Hairpin			
RFC2	Ferrite bead 25 B&S En/Cu	2T			
RFC3	6-hole ferrite choke 25 B&S Tin/Cu				



This probe is required for alignment.



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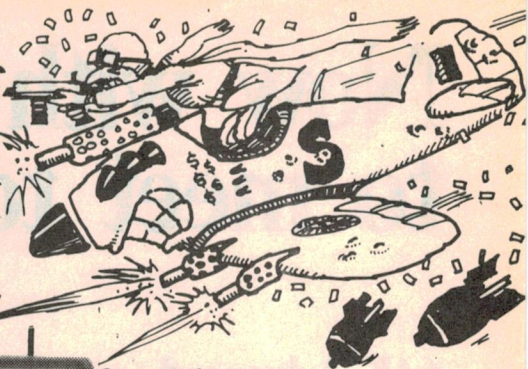
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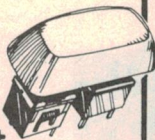


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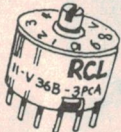
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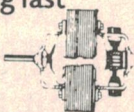
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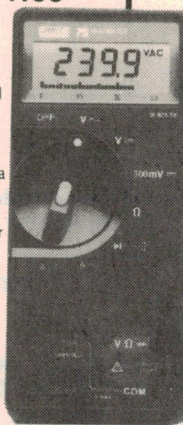
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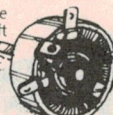
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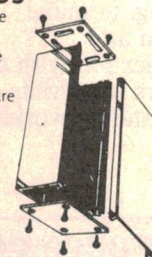


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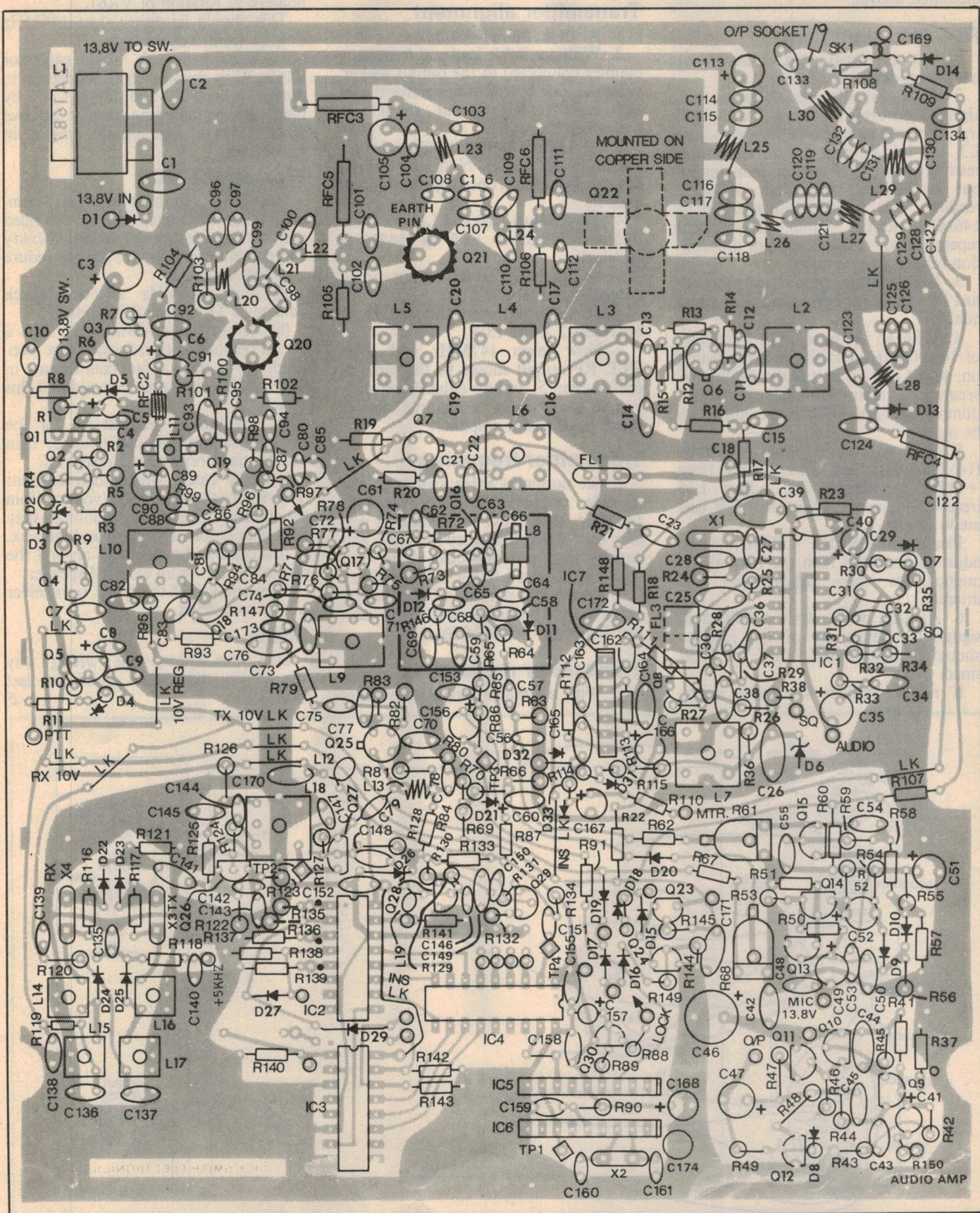
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# VHF amateur transceiver



Use this diagram and the wiring diagram on page 48 to assemble your transceiver.



volts at TP3 should be 4—4.5 volts. Now press the PTT button for a short period and adjust VR68 for 4—4.5 volts as measured above.

## Receiver alignment

1. With no signal input, adjust L7 for maximum noise in speaker.

2. With suitable signal source (ie, signal generator or a hand-held transceiver held near a radio, etc), adjust L2, L3, L4, L5 and L6 for maximum reading on the signal meter, reducing input as required to obtain ½ scale reading. This should be performed at 146MHz (centre band). Your local repeater, slow morse beacon or propagation beacon can be used.

3. With a known input frequency, adjust L6 and L7 for best sound (best audio quality).

4. With an accurate input frequency of 146.005MHz and the +5kHz switch on, adjust L14 for best audio quality. (A separate 2 metre transceiver using a dummy load and in close proximity can be used).

5. With an accurate input frequency (146.000MHz), now select switch from +5kHz to normal and adjust L15 (receiver frequency adjustment) for best audio quality.

Please note that the +5kHz must be adjusted first, and then the normal frequency, as these adjustments will interact.

6. At this point, with a calibrated signal, the sensitivity of the receiver should be better than 0.5µV for 12dB sinad.

If minor receiver instability is ex-

perienced, change R12 from 10kΩ to 12kΩ. This is due to the variation in gain of the RF amplifier, Q6.

## Transmitter alignment

1. Align at 144MHz simplex.

2. With a suitable load and frequency counter connected to the output socket, press the PTT button and monitor the input current. RF output should be available.

3. At 144MHz simplex, adjust L9 for maximum RF output. Note that this is a critical adjustment; once adjusted, do not alter it.

4. Then adjust L10 and L11 for maximum RF output (still at 144MHz simplex).

5. At this point, the RF output should exceed 10 watts.

Approximate current drain is 1.9A at 10W and 2.2A at 15W.

6. Now select 147MHz and press PTT. RF output should be the same as that in Step 5, and no adjustment is required. (No tuning is required due to broad band power amplifier).

## Transmitter frequency

1. Set normal/+5kHz switch to the +5kHz position. Set frequency to 146MHz, then press PTT, making certain that both frequency counter and dummy load are connected to the output. Then adjust L16 for 146.005MHz.

2. Switch the normal/+5kHz switch in the normal position and adjust for correct frequency (ie, 146.000MHz).

## Transceiver modulation

1. With a suitable modulation meter

or monitor receiver, adjust VR61 for 5kHz peak deviation. The setting for 5kHz peak deviation should be approximately ½ rotation of VR61.

This should be adjusted at 146MHz simplex (centre of band range).

2. Adjustment of twist capacitor C169: With dummy load connected to output, press PTT and adjust C169 by tightening or loosening turns to achieve 90% FSD on signal/power meter in transceiver.

## Waxing the VCO

Once the alignment has been completed, the VCO enclosure can be filled with wax to ensure mechanical stability and prevent microphony. The procedure is as follows:

(a) With 144MHz selected, check voltage at TP3. Note this reading.

(b) Using your soldering iron, melt a liberal coating of transformer wax (supplied) on to the various components in the VCO but do not cover coil L8 at this stage;

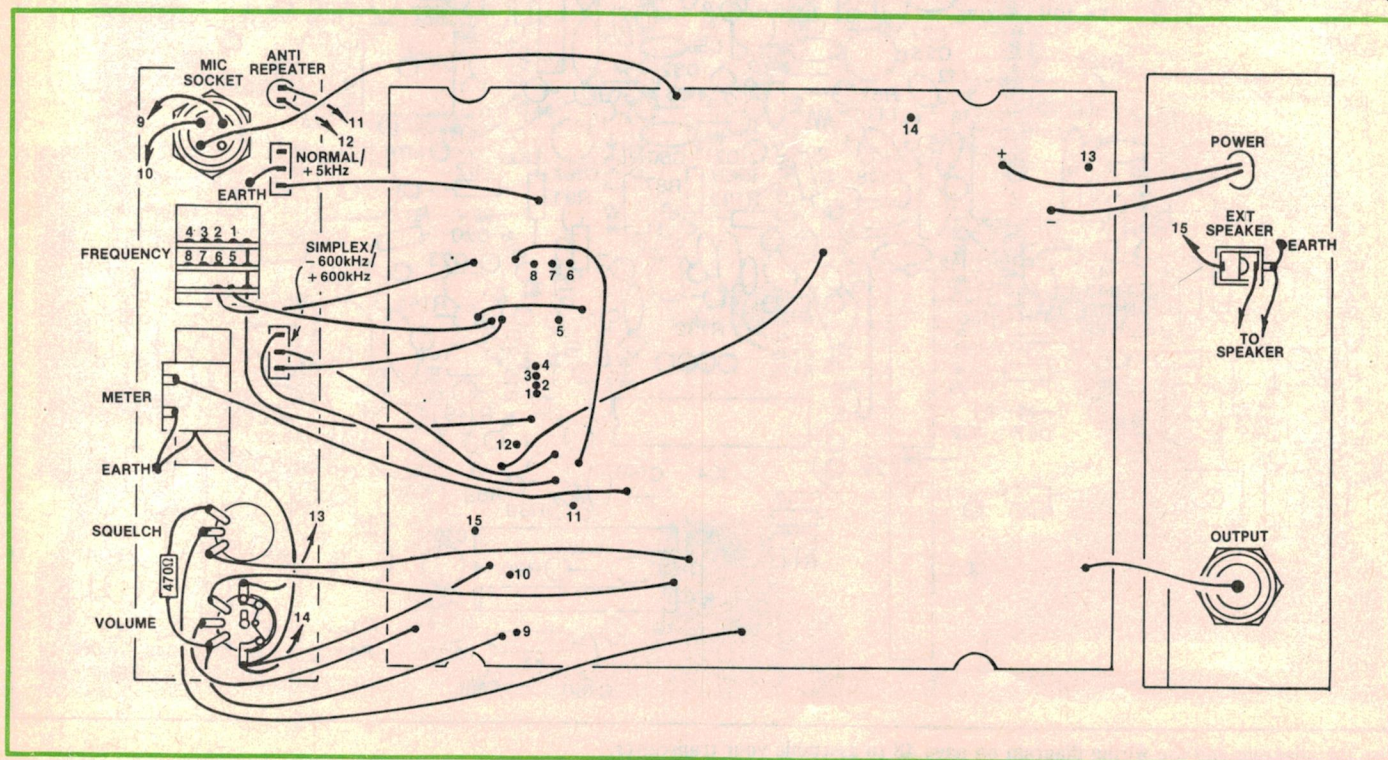
(c) When cool, readjust L8 for the voltage reading previously noted; then use the transformer wax to seal L8.

In some cases, where high ambient noise forces the use of high volume from the internal speaker, microphonics may still occur despite the shield and the wax. If this occurs, the best way around the problem is to use an external speaker.

Construction of the VHF transceiver is now completed.

## Errata

D18 was shown the wrong way around on the circuit published last month.







# Ready for a new challenge?

## Build yourself a 2m transceiver



So many amateurs who built our UHF 'Explorer' kit have written in and asked us for more. They were delighted to be able to build something again – instead of buying a 'black box'! But they wanted more . . .

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 Mode: F3, up to 10kHz deviation (normal operation 5kHz)  
 Supply: 12-15V DC, 110mA-300mA receive, 2.5A transmit  
 Power output: 10W minimum, typical 15W or more  
 Protection: 3A in-line fuse, reverse polarity protection. Can withstand 5:1 VSWR (inc short/open circ) for 2 minutes; audio can withstand open circuit indefinitely and momentary short circuit.

### Transmitter

- Distortion: Less than 10% at 3kHz deviation  
 Spurious: Better than 60dB below carrier.  
 Harmonics: -60dB

### Receiver

- Sensitivity: Max 0.5uV for 12dB SINAD (typically 0.4uV)  
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As described in Electronics Australia, June 1984 issue

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See page 98 for address details



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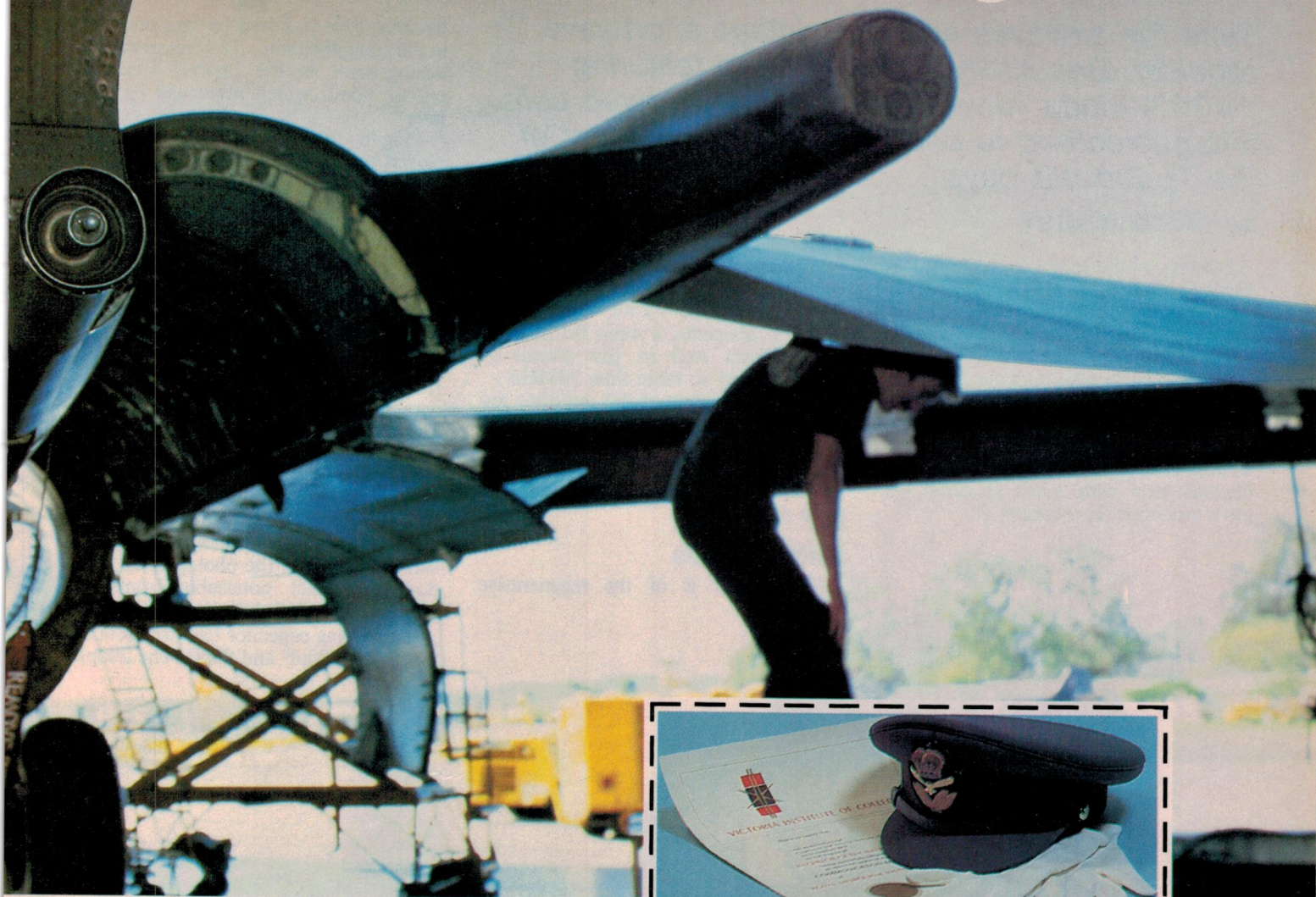
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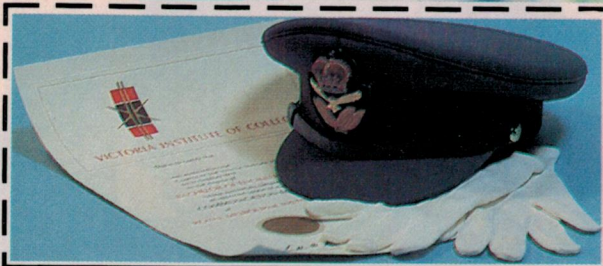
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# Build an antique

*Tune the airwaves with this vintage shortwave receiver. Beautifully presented and featuring 1930's triode valves and plug-in spiderweb coils, it is guaranteed to bring back the excitement of the "good old days".*

by DAVID WHITBY

Judging by the response to the article *How To Build A 1920s Wireless Set*, in the November 1983 issue, there is a real interest in experimenting with early circuit designs and techniques.

Many readers who built the Unidyne one valve set also expressed interest in the possibility of an all band set with plug-in coils, built to the same vintage standards as the Unidyne. So by popular demand (and with much pleasure) we have produced the *Reinartz 2*.

We have designed the set around two medium-impedance triode valves, type HL2K (RAF type VT50). These valves have 2V filaments, a 4-pin British base and perform well in this circuit at frequencies up to more than 20MHz.

Obviously, valves of this era (they are a 1930s design, and were made at the beginning of WWII) are now as scarce as hens' teeth, but sufficient stocks are held to enable several hundred of these kits to be produced.

## Main features

The circuit is of the regenerative

detector type followed by one stage of audio amplification. The regeneration arrangement is the famous Reinartz circuit, about which more will be said later.

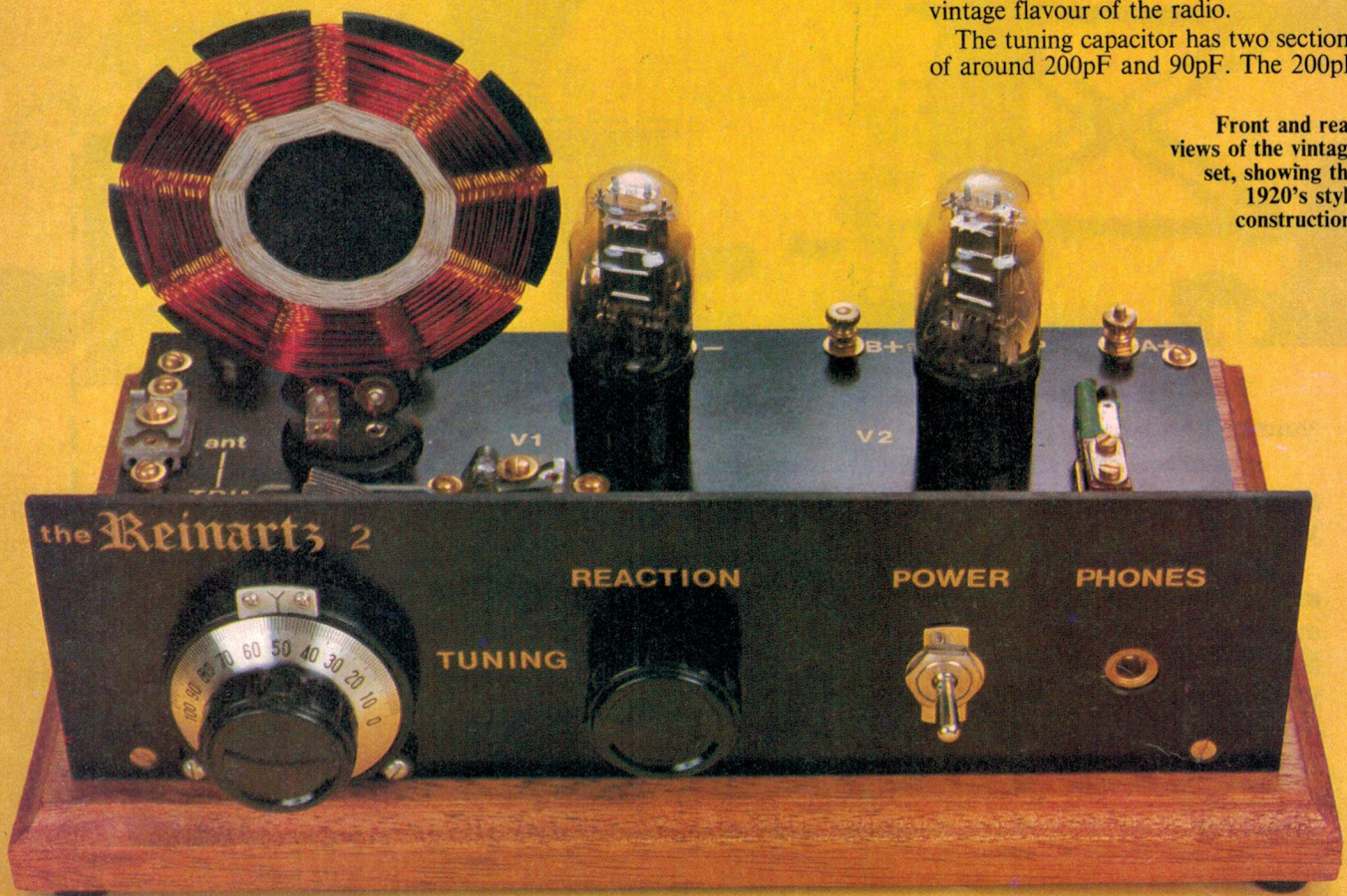
Plug-in "spiderweb" coils are employed to cover the various wavebands (broadcast to approx. 20MHz). The plug-in formers for these have been specially produced for the kitset and allow for easy winding of coils that are very efficient, even though they were first designed around 70 years ago.

The kitset is supplied with three of these plug-in formers, with spares available separately for those who would like to experiment with other wavebands.

Tuning is carried out by an air-spaced variable capacitor which is driven by a precision 6:1 vernier dial. Both the capacitor and the dial are of relatively modern design but make for precise and stable tuning on the shortwave bands. As can be seen from the photographs, they do not detract noticeably from the vintage flavour of the radio.

The tuning capacitor has two sections of around 200pF and 90pF. The 200pF

Front and rear views of the vintage set, showing the 1920's style construction.





# shortwave radio

section is used for tuning the set while the other section is connected via a 30pF trimmer capacitor (C8) to the reaction capacitor (see circuit). Although not a feature of the original Reinartz circuit, this last step reduces the amount of travel required by the reaction capacitor over each tuning range.

The reaction capacitor has been built especially for the kit and consists of a 25pF airspaced beehive capacitor fitted with a shaft and mounted in a brass frame. This little capacitor has the advantage of requiring four turns of the shaft from minimum to maximum capacity which, in effect, gives a vernier action to the reaction control.

In terms of appearance, the set is built on a high quality (Meranti) wooden baseboard, which has a "cove" routed edge to create a really attractive vintage appearance. The tuning and reaction controls, on/off switch and phone jack socket are mounted on a front panel of gold lettered black bakelite, which is attached to the baseboard by means of

## PRICE PANEL

A full kit of parts for the Reinartz 2 are available from Technicraft, 338 Katoomba St, Katoomba, NSW 2780. Phone (047) 82 3418.

Prices are:

Basic kit (does not include headphones or power supply).....	\$77
Vintage Style "A" and "B" Battery Holder.....	\$21
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Spare Valves (HL2K).....	\$ 7
Spare Plug-in Coil Formers.....	\$ 3

Note: Prices include packing and postage. Please allow four weeks for delivery.

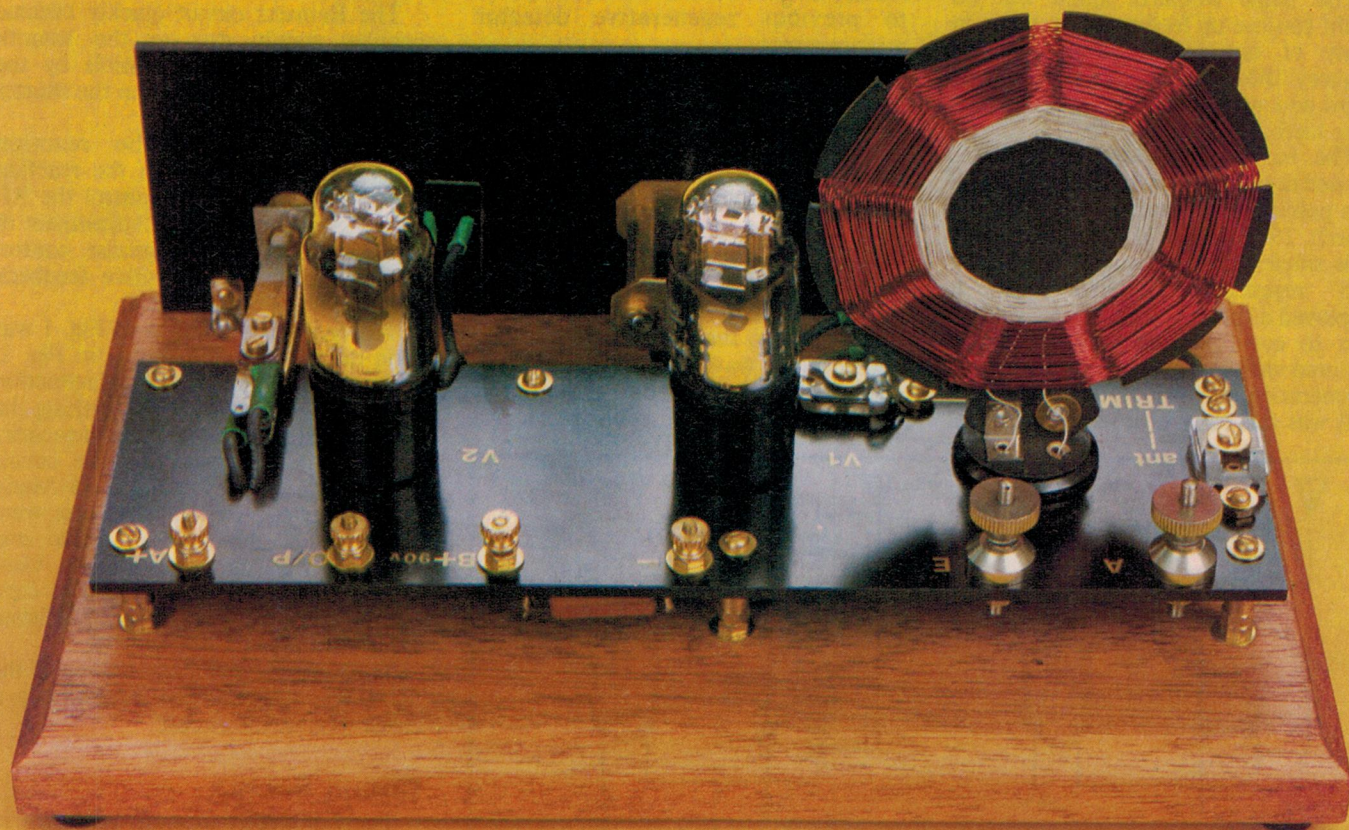
three small right-angle brackets.

A rear sub panel, also of black bakelite, holds most of the other components, including the coil and valve sockets, and the terminals for the aerial, earth and power supply connections.

The set is designed to operate medium or high impedance headphones. If you have built the Unidyne kit and would like to use the low impedance phones supplied with that kit, then a small

valve output transformer (ratio not particularly critical) should be used for best results. There is room to fit this on the baseboard behind the front panel. For those who require headphones, a suitable set of high quality 3400Ω STC phones is available (1940 vintage).

The set requires an "A" battery voltage of from 3-4.5V at around 100mA, and a "B" battery with a voltage of 90 volts or thereabouts at approx





# Build an antique shortwave radio

1.5mA. Two heavy duty alkaline "D" cells will provide a suitable supply for the filaments while a series string of 10 216 9V batteries will provide a very long-lasting "B" battery.

A battery box to hold these could be easily made up and the battery snaps for the 216 batteries and holders for the D cells are cheap and easy to obtain. If you don't want to go to the trouble of making your own battery box, then a complete battery holder system mounted on a wooden base to match the radio is available (see photograph).

An AC-powered supply which also contains an audio amplifier and a small loudspeaker is also available as a kit. This supply can also be used to power up the Unidyne and provide loudspeaker volume, making it possible to share the listening experience with friends and family. Further details of this are given towards the end of the article.

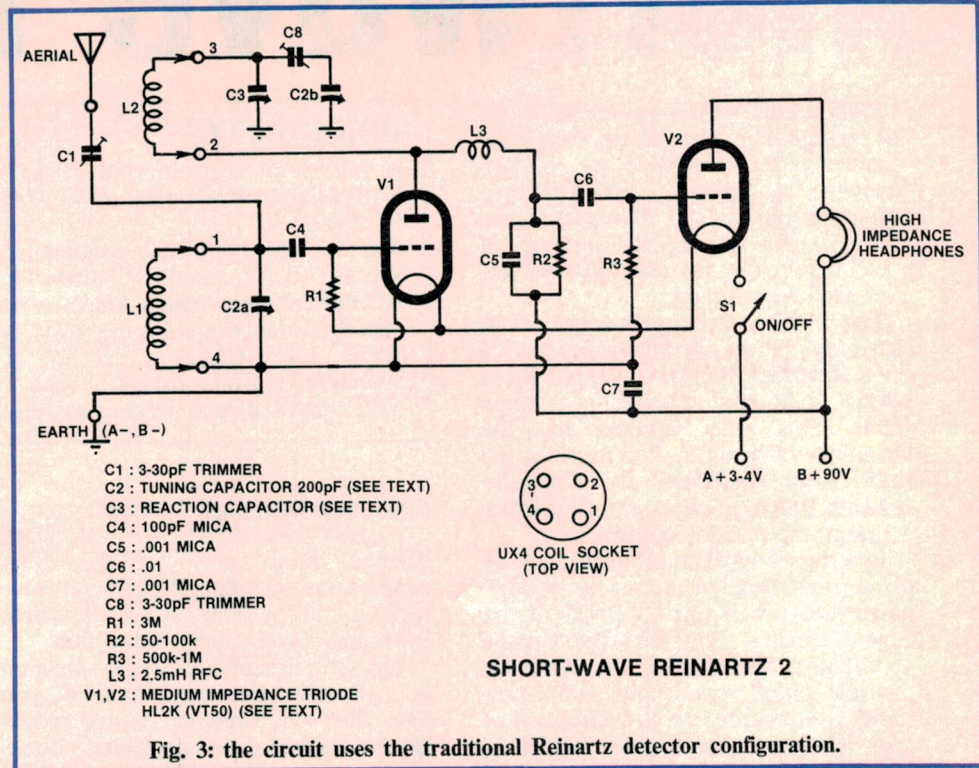
## The Reinartz Circuit

Of all the sets built by hobbyists over the years from the 1920s onwards, the all-band one or two valve sets with plug-in coils were probably the most popular. Of these the Reinartz circuit was undoubtedly the best known.

The name Reinartz alone will no doubt conjure up feelings of nostalgia in many of our readers and bring to memory those exciting and sometimes weird and wonderful little sets they cut their teeth on.

The basic circuit arrangement was devised in the USA by J. L. Reinartz and was published in the June 1921 and March 1922 issues of *QST* magazine. This single valve set was of the "leaky grid" regenerative detector type. It employed a spiderweb coil with switched taps to cover various wavebands and featured variable capacitor control of the regeneration (or reaction).

It was this capacitive reaction control



which was the main distinguishing feature of the Reinartz circuit compared to previous regenerative detector arrangements.

Previous methods of regeneration control included the "swinging reaction coil" (as in the Unidyne set), the tuned anode Variometer circuit (due to Armstrong), and other methods which used a fixed reaction coil coupled to the tuning coil and controlled the amount of reaction by varying the filament or anode voltages of the valve.

All of these methods were workable (some more so than others) on the long and medium wavelengths, but when it came to operation on the shorter wavebands, reaction control became

very tricky. An unstable receiver was often the result.

The Reinartz circuit quickly became popular mainly due to the smooth reaction control made possible by the arrangement — especially on the shorter wavelengths.

Simply explained, the reaction capacitor is in series with the reaction coil and is thus able to control the RF current through this coil. Adjustment of the capacitor provides precise control over the amount of positive feedback (regeneration) in the circuit.

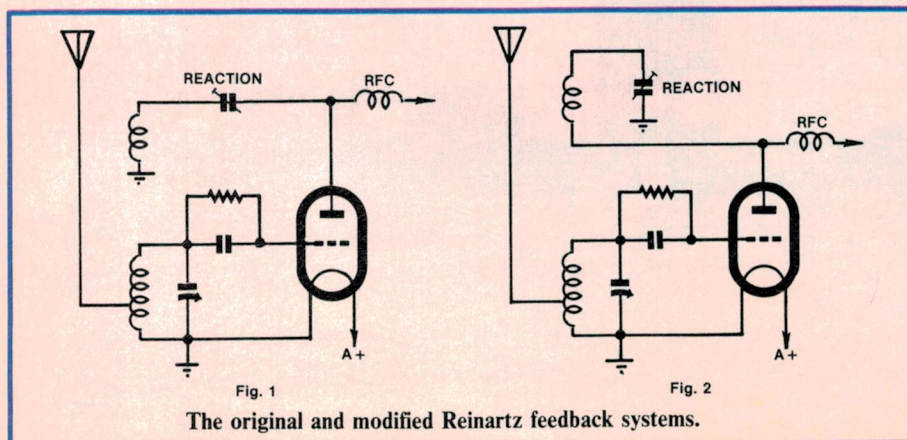
The basic circuit shown in Fig. 1 was soon modified to that shown in Fig. 2, the main improvement being a reduction in body capacity effects by earthing the moving plates of the reaction capacitor.

It was in this form that the circuit became widely known and used. Many one and two valve Reinartz sets were described in the pages of *Radio and Hobbies* over the years. These went under such names as *Little Jim* sets, many versions of which were published from the 1930s until the 1950s.

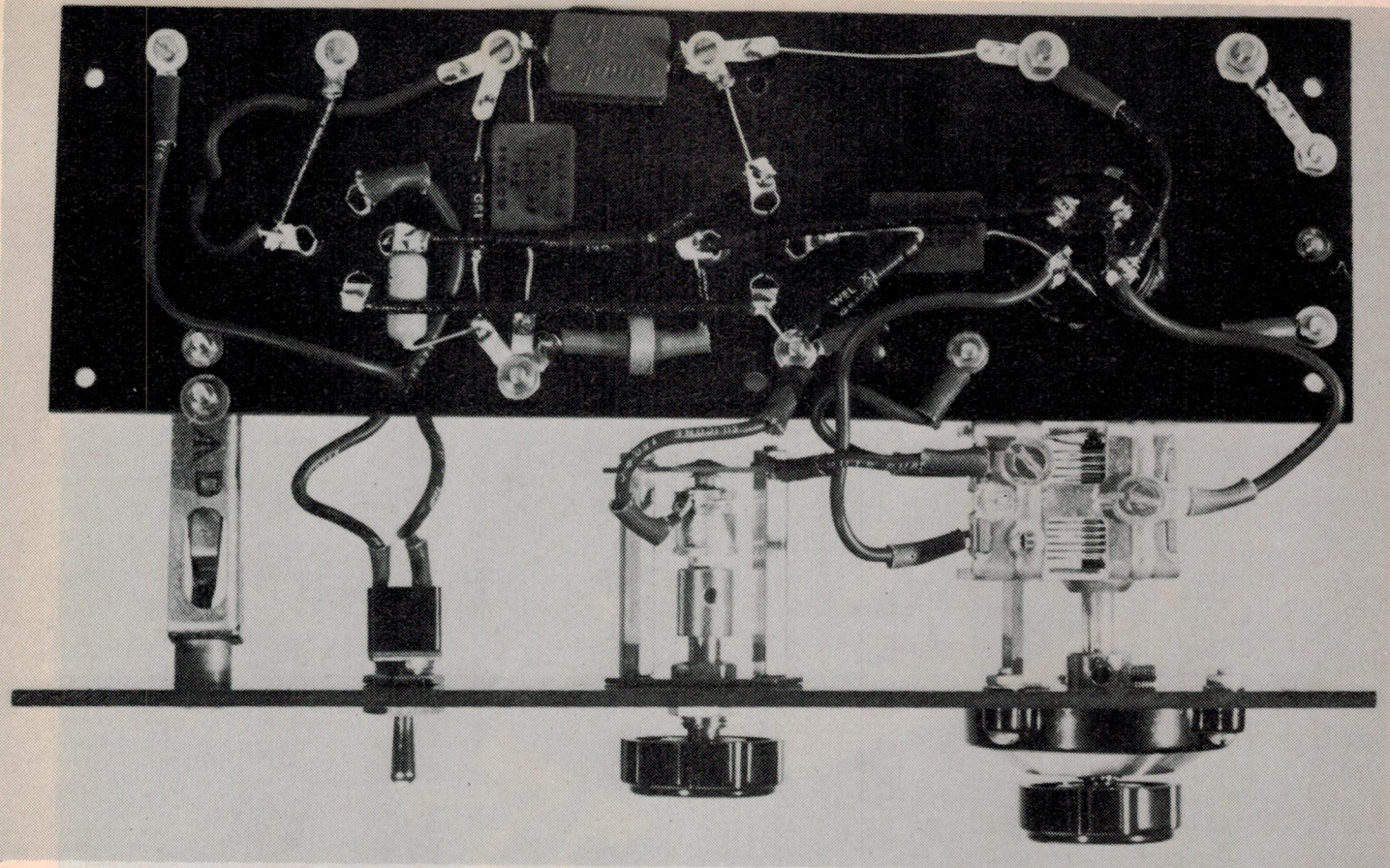
The Reinartz 2 embodies many of the features of the earlier sets, so let's take a closer look at the circuit.

### Circuit Details

The full circuit diagram is shown in Fig. 3. Signals from the aerial are coupled via C1 (3-30pF trimmer) into the







View showing the sub panel wiring and connections to the front panel components.

tuned circuit L1 and C2a. Those frequencies selected by the tuned circuit are detected by the grid of V1 which together with C4 and R1 forms a "leaky grid" detector arrangement (for a full explanation of this, refer to the Nov 1983 article). To improve the sensitivity of the detector to weak signals, "grid leak" resistor R1 is connected to the positive side of V1 filament.

Regeneration is accomplished by L2/C3 which feeds back some of the RF energy amplified by V1 into L1 in such a way as to aid the original signal and bring about a great increase in gain and selectivity. The setting of C3 controls the

amount of regeneration, the optimum setting being just short of the point of oscillation (as evidenced by a high-pitch howl).

L3 is an RF choke which prevents loading of the regeneration system by the following stage. It also operates in conjunction with bypass capacitor C5 to prevent RF currents from passing to the output stage. An RF choke in this position was always a feature of the Reinartz sets.

Audio signals developed across V1 load resistor R2 are coupled via C6 into the grid of V2 which drives the headphones.

It will be noted that the valve filaments are connected in series. This is done to provide an effective negative grid bias voltage for V2 — obtained by virtue of the fact that both sides of V2's filament are positive with respect to the grid which is at earth potential through R3.

C7 is an RF bypass capacitor across the "B" supply and S1 switches power to the set by making or breaking the filament supply.

## Construction

The first thing to do is to finish the wooden base. This comes routed and drilled and requires only fine sanding and then two coats of satin polyurethane with a light sanding between coats. While this is drying the tuning and reaction capacitors and the on/off switch can be fitted to the front panel.

Put this aside and then fit all the major mechanical parts to the sub panel as shown in Fig. 4. The various electronic components can then be soldered in position and the wiring run using the black rubber-covered wire supplied with the kit.

When the baseboard is thoroughly dry, screw the four rubber feet into the four corner holes. This done, fit the three right angle brackets which hold the front panel in place (use the woodscrews supplied) and mount the six 3/4-inch

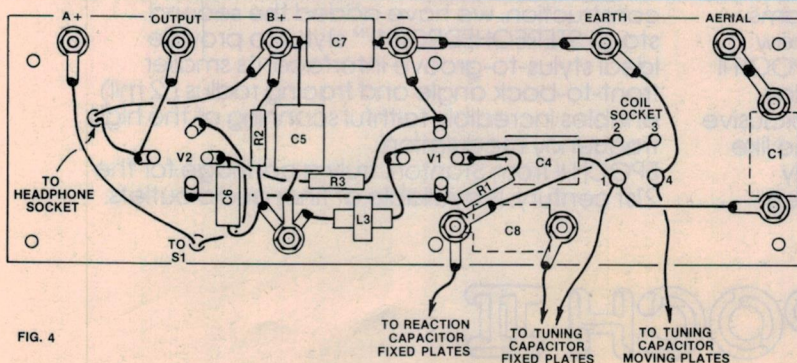


FIG. 4

Wiring diagram of the sub panel. Compare it with the photograph above.



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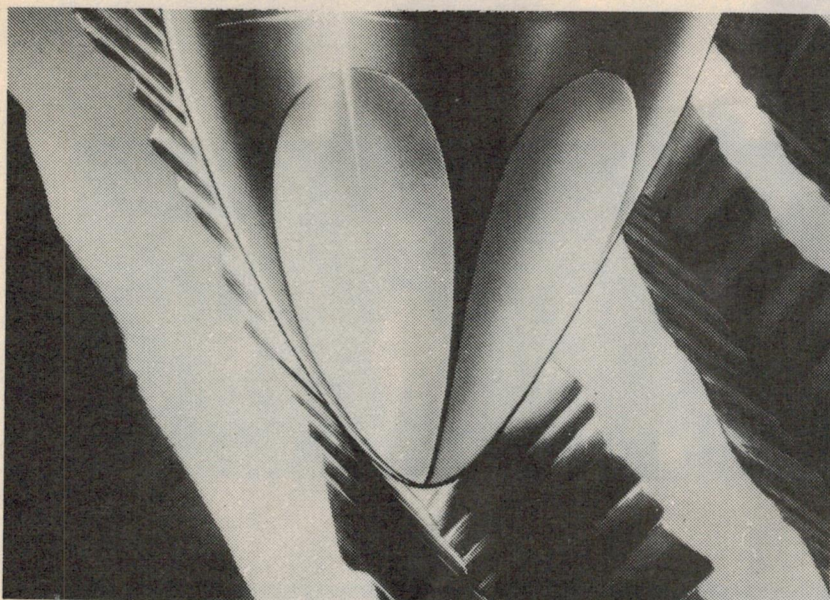
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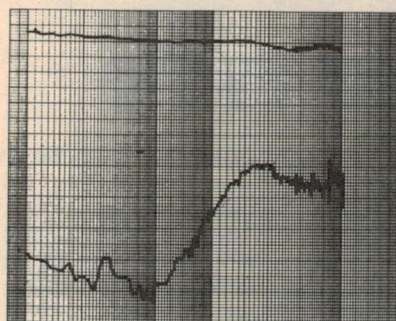
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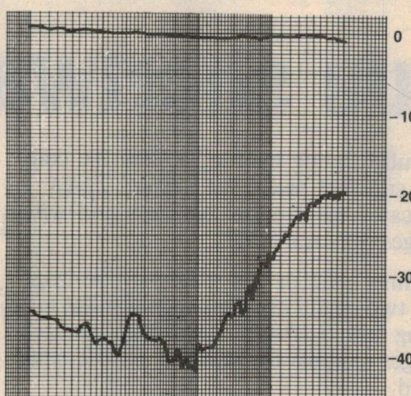
## SPECIFICATIONS:

Detailed specifications are given in the Epoch II leaflet available from the dealers listed below. Just to whet your appetite, frequency response is 10Hz - 50kHz for the LZ9S (try Compact Disc against that!), tracking ability is 90 microns (or, it will play any record ever pressed, with minimal distortion).

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Typical frequency response of LZ9S and channel separation.



Typical frequency response of HZ9S and channel separation.

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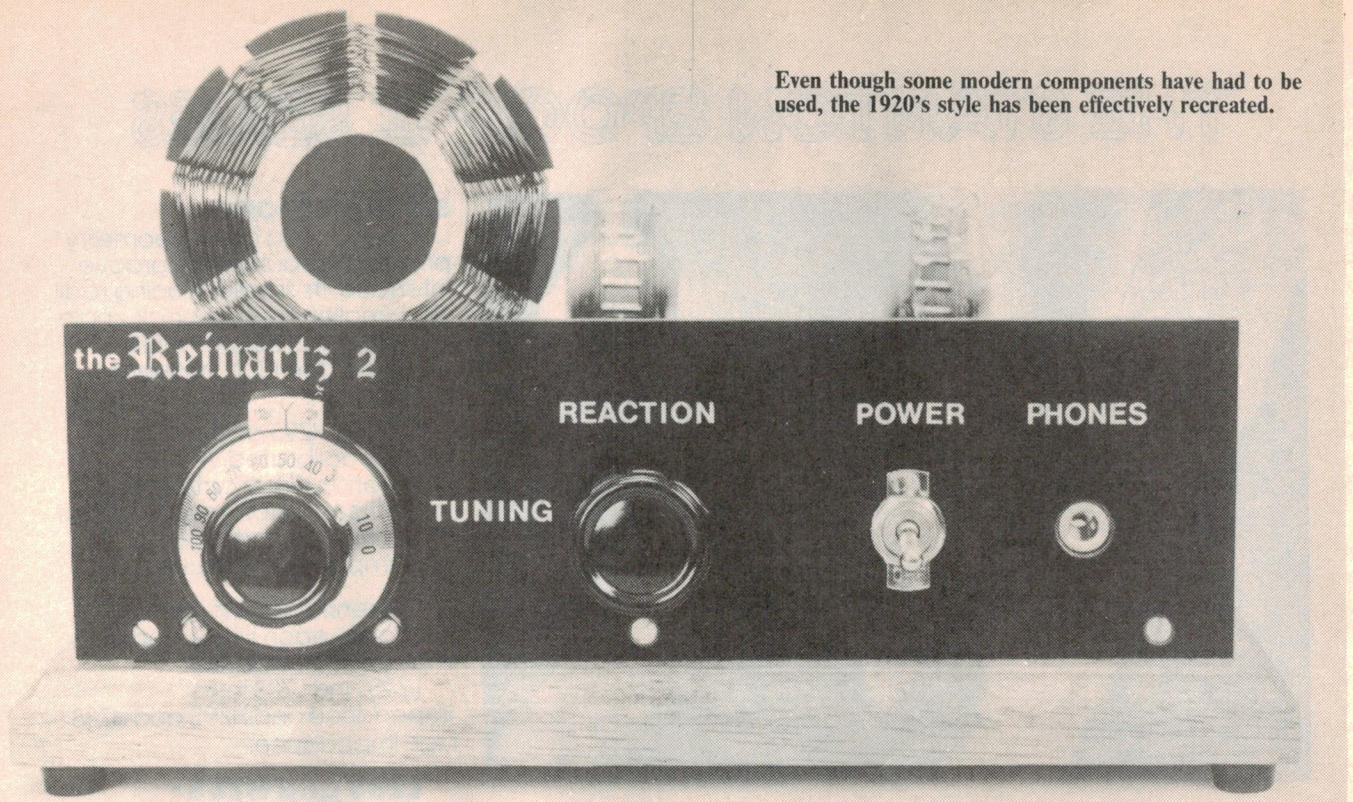
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Even though some modern components have had to be used, the 1920's style has been effectively recreated.



## Build an antique shortwave radio

tapped brass spacers by means of the 1-inch x 1/8-inch screws from underneath the baseboard.

Both panels may now be fitted to the baseboard with the screws supplied and the wiring from the back panel to the components on the front panel completed according to the circuit and wiring diagrams. Make sure that you don't transpose the connections to the fixed plates of the tuning capacitor (C2). Pin 1 of L1 goes to the 200pF section while the lead from C8 goes to the 90pF section.

Full winding instructions for the coils are supplied with the kitset. Table 1 indicates the number of turns and wire gauges for each band.

Three plug in coil formers (one large and two small) are supplied with the kit, along with a selection of wire of various gauges suitable for winding all the coils listed.

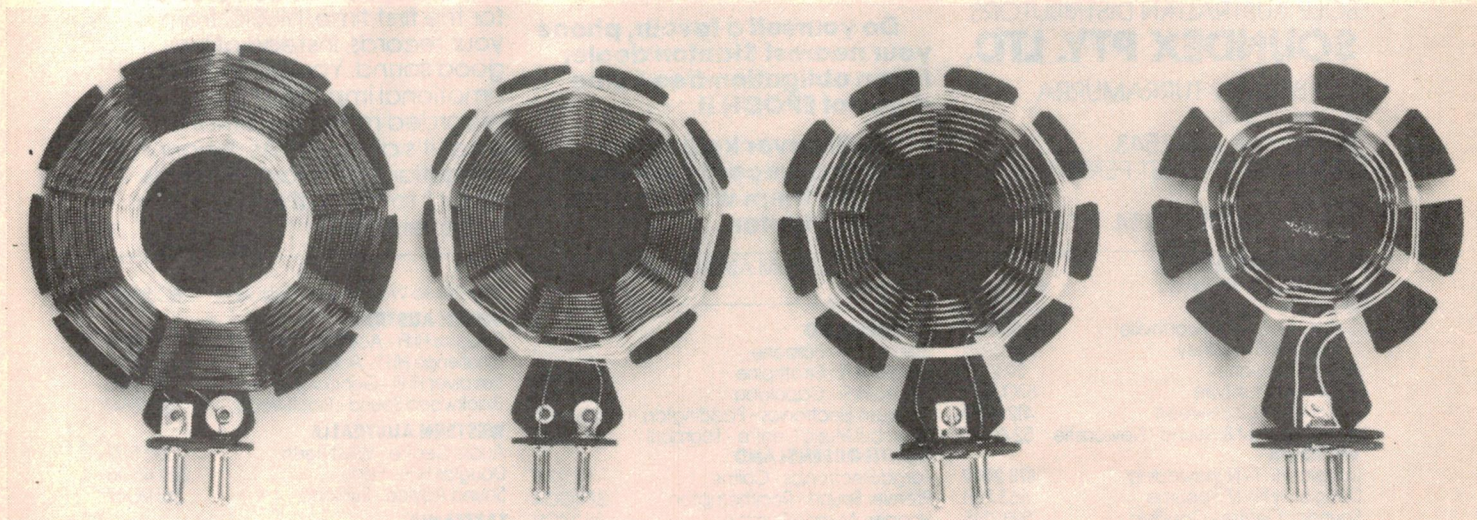
The band covered by coil No. 2 on the chart is probably the least important as there are very few worthwhile stations in this band. Winding details for this band

are included mainly to make the chart complete.

Spare coil formers and wire are available for those who would like to experiment with this band or other bands, such as those below 550kHz or above 20MHz.

### Aerials

For best results an outdoor aerial (antenna?) of from 10-30 metres long and mounted as high as possible is desirable. However, quite respectable results can be achieved with a good indoor aerial in



These four plug-in coils provide coverage from 560kHz to 19MHz. Table 1 shows the winding details.



many locations (10-15 metres of wire around the room, etc). In most cases an earth will be found advantageous. A guide sheet to suitable aerials and earths is supplied with each kit.

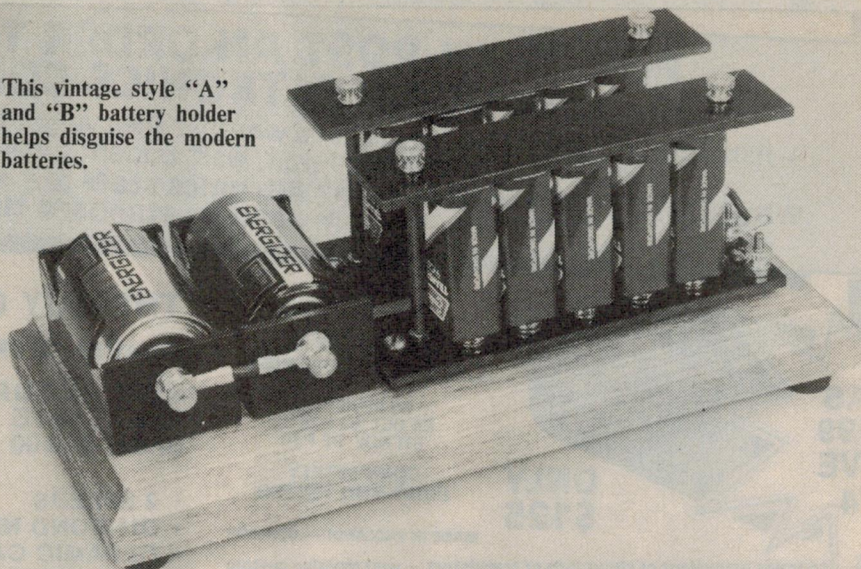
When you are trying the set on any band for the first time start with the reaction capacitor plates fully out of mesh and vary the setting of the tuning capacitor. You will probably hear some stations even if only weakly.

Tune so that the station you want comes in as loudly as possible. Then gradually turn the reaction capacitor so that the plates come into mesh. The volume of the station will increase as you do this, and if you now check the setting of the tuning capacitor you will find that it has shifted slightly. After a little practice you will be able to tune the set very accurately in a few seconds.

At higher frequencies, the setting of both controls becomes more critical and more skill is required to obtain the best results. You may find it easier to make tuning a two-handed job. In any case, it is interesting to note that with correctly adjusted regeneration the set performs as well as much larger sets do without regeneration.

With a good aerial and earth and careful tuning an amazing number of

This vintage style "A" and "B" battery holder helps disguise the modern batteries.



stations can be received, especially at night, on all bands.

### AC Power Supply/Audio Unit

Before closing, a few words about the AC power supply, which has been designed for this set and also for the Unidyne.

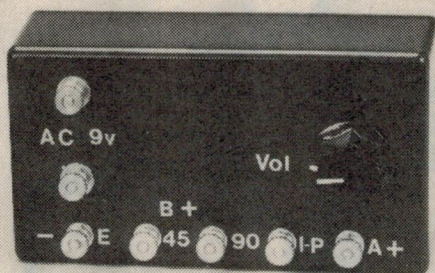
This supply utilises a 9-volt AC plugpack and by means of a voltage

multiplier provides approx 45 volts (for the Unidyne) and approx 90 volts (for the Reinartz 2). A rectifier/filter and IC regulator is employed to provide a filament supply of 3.6 volts which is suitable for both sets. An IC audio amplifier together with a volume control and speaker is also included, enabling loudspeaker output from both these vintage sets.

Most of the components for this are mounted on a printed circuit board and the whole circuit is housed in a black moulded box with brass terminals for all inputs and outputs.

This unit is a worthwhile addition to both of these vintage sets and as well as eliminating battery costs enables the listening experience to be shared with others.

We hope you will get as much pleasure from building and operating the "Reinartz 2" as we have from hunting down the parts and re-creating this little item of radio history.



Above: optional AC supply/audio amplifier unit (see text).

COIL	FREQUENCY RANGE	L1 (TUNING)	L2 (REACTION)	COMMENTS
1	560kHz-1.5MHz BROADCAST	60T 26 B&S ENAMELLED	40T 33DCC OR 30 B&S ENAMELLED	REACTION COIL WOUND ON FIRST. 3-3/4" DIA. FORMER
*2	1.5-3.6MHz	24T 24 B&S	14T 33DCC	TUNING COIL WOUND ON FIRST. REACTION COIL SPACED 1/8" FROM TUNING COIL. 3-1/8" DIA. FORMER
3	3.45-8MHz	12T 20 B&S	7T 26DCC	WINDING AND FORMER AS FOR NO. 2.
4	7.7-19MHz	5T 18 B&S	4T 26DCC	MOST INTERNATIONAL SHORT-WAVE TRANSMISSIONS ARE IN THESE BANDS

\*OPTIONAL

Table 1: coil winding details (see text regarding coil 2).



A rarity these days: genuine high impedance headphones.



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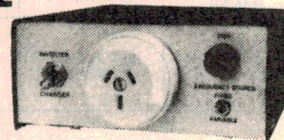
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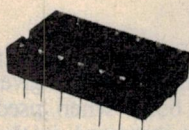
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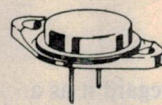
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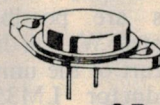


Z1510 2SK 134  
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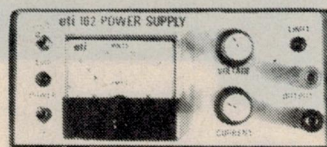
Z1174 **\$1** EA

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Z 0141	Led 3mm Green	.20	.18
Z 0143	Led 3mm Yellow	.22	.20
Z 0150	Led 5mm Red	.14	.10
Z 0151	Led 5mm Green	.20	.18
Z 0152	Led 5mm Yellow	.22	.20
Z 0154	Led 5mm Orange	.25	.22
Z 0159	Led 5mm Flashing FRL4403	.49	.45
Z 0160	Led Rectangular Red	.22	.19
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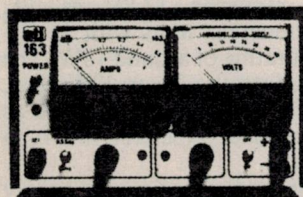
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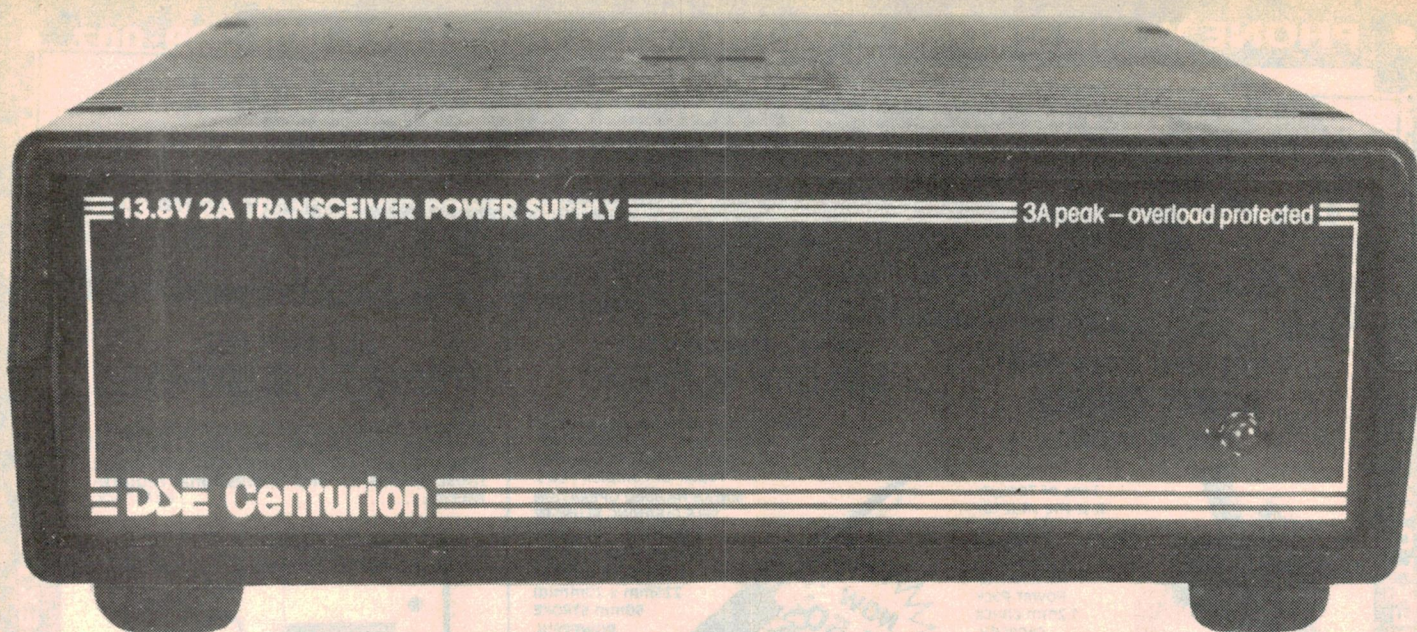


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# 13.8V transceiver power supply

*Looking for a 13.8V power supply for your amateur band transceiver? This easy-to-build unit will power both the UHF "Explorer" and VHF "Commander" transceivers recently described in EA and comes in a matching case.*

by PHILIP WATSON

As with the two transceiver kits, the power supply kit is being marketed by Dick Smith Electronics, and is packaged in the same plastic case as the transceivers; a nice touch for those who like to maintain a neat appearance on the shack operating table.

On the other hand its use is not restricted to these two units. It is quite suitable for use with most 2m or 70cm transceivers requiring 13.8V at 2A; typically, commercial units with an RF power output rating of around 10W. The next step up, into the 25 or 30W class, would require something larger, such as the VK Powermate, described in EA in December 1983.

The circuit for the new power supply is just about as simple as one could get for a unit of its ratings and performance

figures. In fact, some may regard it as a little too simple, but some worthwhile additions are possible, and easily implemented. We will discuss these later.

The heart of the unit is the National Semiconductor LM350T adjustable regulator. This has a rating of 3A with an output voltage variable from 1.2V to 33V, with only a minimum of external components. It is self-protecting, with internal current limiting, thermal overload protection, and safe area (power dissipation) protection.

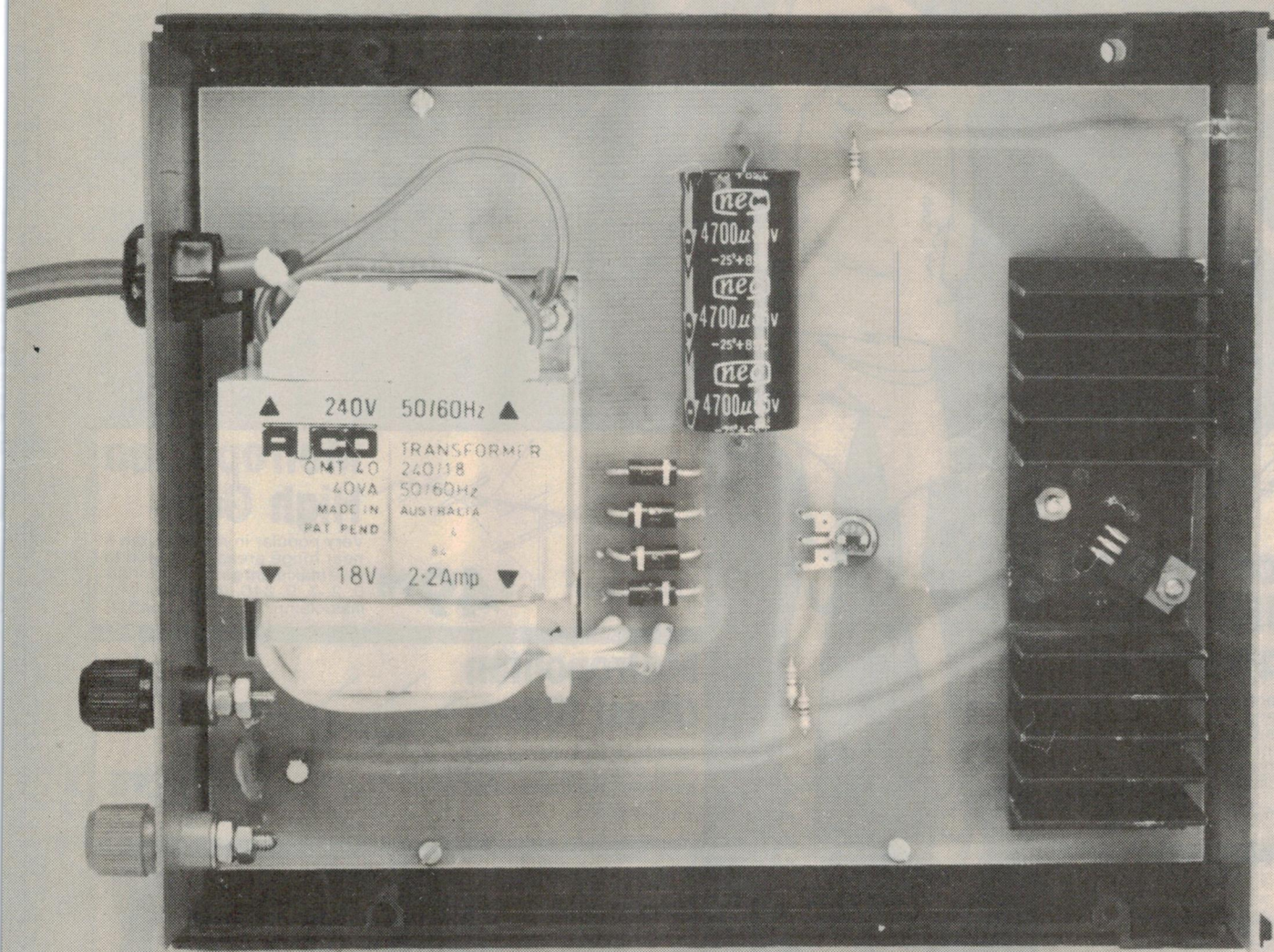
Used in a simple circuit such as this, the regulator still offers an impressive performance: voltage output drops by only 10mV from no load to 2A; ripple and noise is 15mV p-p at 2A, rising to 100mV p-p at 2.5A; and input voltage regulation holds down to 220VAC.

As a matter of interest the ripple rejection ratio for the LM350, as given in the data sheet, is 65dB when used as shown. This can be increased, in theory at least, to 86dB by bypassing the adjustment terminal with a 10 $\mu$ F capacitor. More about this idea later in the article.

The operation of the regulator is perhaps best explained with the aid of the simplified diagram in Fig.1. This shows it as consisting of a power transistor in an emitter follower configuration, with the base being fed from the output of an operational amplifier. The input to the operational amplifier is taken from the output of the emitter follower, thus making it a feedback system. More specifically, the op amp monitors the voltage across R2 and adjusts the drive to the power transistor to keep the output voltage within tight limits.

The whole system is so adjusted that it strives to maintain a constant value of about 1.25V across R2 which means that, in turn, it also maintains a constant current through R2 and thus, by definition, the same constant current through R1. By selecting the value of R1 we can nominate the voltage which will





Use this photograph in conjunction with the circuit when wiring up the supply.

appear between the "OUT" terminal and the negative rail, which will be 1.25V higher than the voltage across R1.

Let us now consider what happens if the output voltage (between "OUT" and negative rail) tends to vary, due to either variations in the input voltage or variations in the load current. Let's say the voltage tends to rise. This would have the effect of trying to force more current through the R2, R1 network and increasing the voltage across R2. But the feedback network will have none of this; it will immediately pull down the forward bias on the transistor, thus lowering the output voltage until the requisite 1.25V is restored across R2.

Similarly, if the voltage should tend to fall, the reverse corrective action would occur. This is a greatly simplified explanation of both the regulator circuitry and the manner in which it functions in the circuit, but it should give the reader at least a basic grasp of what is involved. It also explains how the LM350T can precisely control the voltage between its output and "Adj" pins, while negligible

current actually flows into or out of the "Adj" connection.

In the present circuit R1 is a 1k $\Omega$  resistor and R2 is made up of an 82 $\Omega$  resistor and a 100 $\Omega$  trippot. This is adjusted to give the required 13.8V at the output terminals, using an accurate voltmeter.

The remainder of the circuit is almost basic in its simplicity and calls for little comment. More important from the constructor's point of view is the hardware supplied with the kit and the method of assembling it.

### Mains transformer

One of the most important components is the transformer, partly by reason of its construction and partly because of the manner of mounting it. It is an Australian made "Atco" brand unit, rated at 18V, 2.2A. Apart from being a compact unit it has the attractive feature that both the input and output connections are via well shrouded screw terminals. This allows the constructor to fit his own leads and, in the case of the mains connections, allows the cable leads

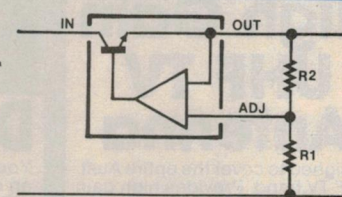


Fig 1

The 3-terminal regulator contains a power transistor and an operational amplifier.

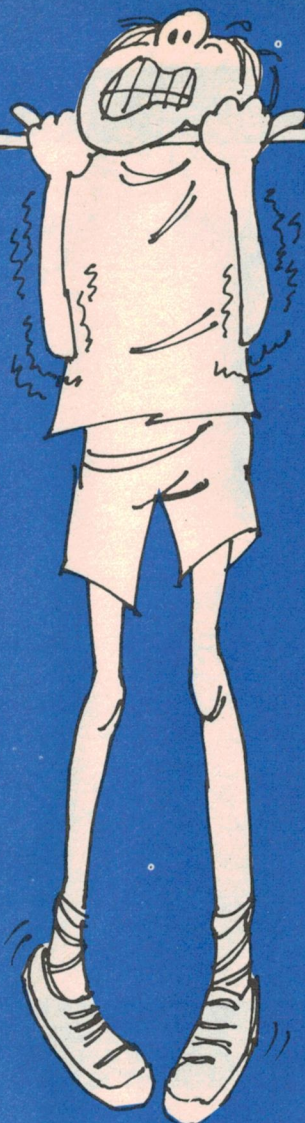
to be taken directly into the transformer, thus avoiding the need for insulated terminal blocks.

Unfortunately, mounting the transformer presented a minor problem. It was too high to allow it to be mounted on a printed board, as normally supported in this plastic case. On the other hand, it could be accommodated if it was mounted directly on the lower half of the case, and this is what has been done, the printed board being supplied with a rectangular cut-out, so that it fits around the transformer.

The next problem was to avoid using mounting screws to hold the



# FIX PICTURE FUZZ!

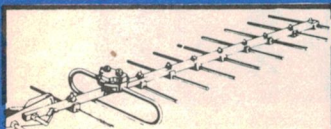


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For good VHF/UHF TV signals you need a good antenna. This one has both in one. Latest 14 element design needs just one feed line, suits 300 ohm includes mast clamp.

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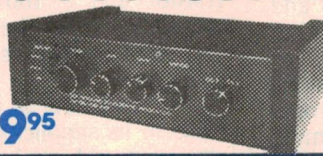
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## Video to Video Cable Set

2m audio/video cable with phono plugs at each end. Adaptors to suit UHF (PL259), BNC, 6.5mm, 5 pin DIN & 6pin DIN.

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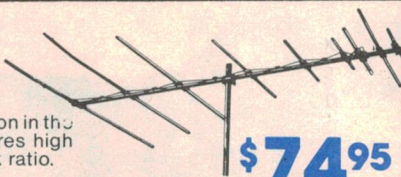
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Ideal for all channel reception in the most difficult areas. Features high gain and high front-to-back ratio.

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## BNC Video Cable

2m 75ohm coax fitted with BNC plugs each end.

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sockets to improve  
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### Wallmount

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28cm long, complete with saddle clamp assembly.

Cat L-4152

### Bargeboard Mount

Mount any TV antenna from vertical surface.

139 cm long.

**\$9<sup>00</sup>**

Cat L-4150

### TV Mast Pipe

2.44m mast section galvanised and rust-proof. 27.5mm dia.

Cat L-4156

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350 stores and resellers throughout Australasia

# DICK SMITH ELECTRONICS

See page 30 for address details



A750





# 13.8V transceiver power supply

transformer, since these would protrude on the underside of the case. The solution was to affix the transformer to the case using a strip of double-sided adhesive. This is supplied with the kit.

The adhesive is about 25mm wide and a single strip is fitted from corner to corner of the transformer, this combination then being applied to the case. The adhesion is very good and difficult to break, so it is important to select the correct position first time.

The only objection to this arrangement is that the cut-out in the board used in our sample model was not quite large enough to clear the top of the transformer, particularly the terminal covers. This would mean that the board would have to be wired — and preferably tested with temporary connections — and mounted in place before the transformer was fitted.

It would also mean that, in the event that subsequent service was required, it would be difficult to get at the underside of the board.

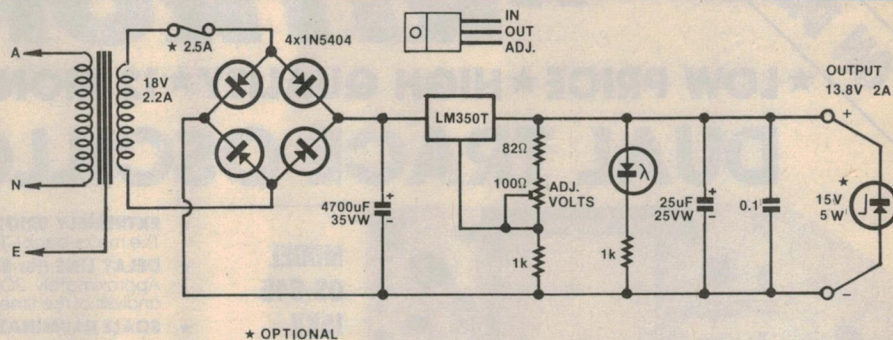
We raised this point with Dick Smith Electronics and they have arranged to have this cut-out enlarged slightly, both for boards in stock and future supplies. However, the constructor would be wise to check this point carefully and, if an undersize cut-out is encountered, to enlarge it slightly, using a file.

Note that one of the transformer mountings holes is fitted with a nut and bolt holding a solder lug, this being used to connect the transformer frame to the mains earth (green and yellow) wire. The screw needs to be countersunk and a lock washer should be fitted to secure the connection.

The rectifier is a conventional bridge arrangement using four 1N5404 diodes, and the output is filtered by a 4700 $\mu$ F capacitor. This is followed by the LM350T regulator, the voltage adjusting resistor network, and a 25 $\mu$ F electrolytic and a 0.1 $\mu$ F ceramic capacitor in parallel across the output terminals. A LED indicator with a 1k $\Omega$  limiting resistor completes the picture.

The only other major structural item is the finned heatsink for the LM350T. This is bolted to the board in such a way that it makes contact with the positive rail, the body of the LM350T being the Vout terminal and which is bolted to the heatsink in both electrical and thermal contact.

Construction should not pose any special difficulties, apart from the few minor points already discussed. The polarity of both electrolytic capacitors is marked on the board, and the orientation of the rectifier diodes can be clearly seen



The circuit consists of a bridge rectifier driving an adjustable 3-terminal regulator.

in the photograph. The LED polarity is indicated by the positive lead being the longer one.

## Optional protection circuitry

Earlier we mentioned possible additions to the circuit. One of these is a fuse to protect the transformer in the event of any failure likely to overload it. While there is no provision for a holder on the board, an in-line fuse holder could easily be added to the longer of the two low voltage leads from the transformer to the board. A fuse rating of 2.5A is suggested.

An alternative approach would be to cut the positive rail between the 4700 $\mu$ F capacitor positive connection and the heatsink, then mount a fuse clip either side of this cut. Electrically, this position has some advantage, particularly if the second protective device, about to be discussed, is fitted.

This second protective device is mainly for the benefit of the transceiver, or other load. In the event of a failure of the regulator or associated components it would be possible for the full output voltage from the rectifier to be applied to the output terminals; around 18V or possibly higher, resulting in damage to the transceiver.

A simple solution to this problem is to fit a heavy duty zener diode across the output terminals, its voltage rating being high enough to clear the normal 13.8V, but low enough to allow it to be activated before a dangerous voltage is applied to the transceiver. If it is activated it will appear as a virtual short circuit to the power supply and blow the fuse.

In readily available types a 15V, 5W unit appears to be a good compromise, although a slightly lower voltage would be better. The next lowest value in 5W units is 13V, which is too low, but the addition of a couple of heavy duty diodes (eg, 1N5404) would raise this to 14.2V

— a nice value if you feel that the extra trouble is justified.

Regardless of which arrangement you use, it is important that it not be connected before the output voltage has been set. And, if subsequent adjustment should be required, it would be wise to disconnect the zener until it is completed.

The third suggestion concerns improved ripple rejection, as already mentioned. In most cases this should not be necessary, because the performance from the circuit as it stands is very good. Only in the event that it is used with equipment which may be lacking in internal filtering, or is unduly sensitive for some other reason, should it be necessary to consider this approach.

The modification is quite simple and involves fitting a 10 $\mu$ F electrolytic capacitor between the adjust terminal and the negative rail. Tried in our own laboratory, there is no doubt that it makes a significant reduction, to the point where the ripple becomes comparable with the noise, making it difficult to measure accurately. It dropped the level from the previously mentioned 15mV p-p to something around 2.5mV p-p; a very worthwhile improvement.

Our only worry concerning this modification was the possibility that it might introduce instability into the regulator system, particularly when used in the vicinity of a strong RF carrier. Happily, an on-air test using a typical 10W 2M commercial transceiver revealed no sign of any such problems, and we feel that, should such an addition seem to be desirable, it would be safe to go ahead and use it.

Which is about all that needs to be said about what is, basically, a very simple project. The kit price is \$49.50 which, with the addition of a couple of hours work, will result in a very effective power supply for either the UHF or VHF transceiver.



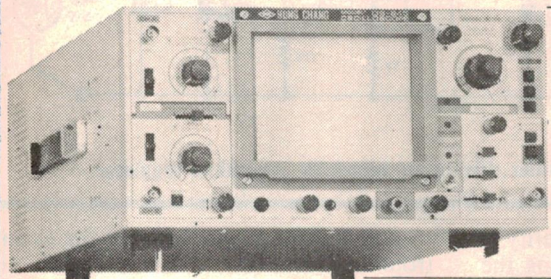
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- ★ **SINGLE SWEEP**  
A triggered sweep of a single waveform can be displayed.
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- ★ **MAGNIFIERS**  
Both vertical and sweep time are simply magnified to 5 times (1mV/div, 40nsec/div).
- ★ **X-Y, or X-Y-Z OPERATION**  
Simply by turning the SWEEP TIME/DIV knob to CH-B, this functions as a very high sensitivity X-Y oscilloscope (1 mV/div) with intensity modulation.
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High frequency noises can be rejected for the stayble triggering by use of the low pass filter built in the triggering circuit.

**COMPLETE MODEL RANGE SPECIFICATION CHART:**

MODEL	SCREEN	SENS	SIG	TRIG	B'WIDTH	T'BASE	WITHOUT PROBES	TAX EXEMPT	WITH PROBES	CAT No.	COMMENTS
645	150mm	1mV	DEL	DEL	45MHz	0 2uS 0 5Sdiv	\$995.00	\$895.00	\$1055	Q12110	(70MHz-6dB)
620	150mm	5mV	N	N	20MHz	0 5uS 0 5Sdiv	\$495.00	\$425.00	\$549.00	Q12105	(45MHz-6dB)
615S	95mm	5mV	N	N	15MHz	0 5uS 0 5Sdiv	\$695.00	\$615.00	\$759.00	Q12100	AC-DC Operation

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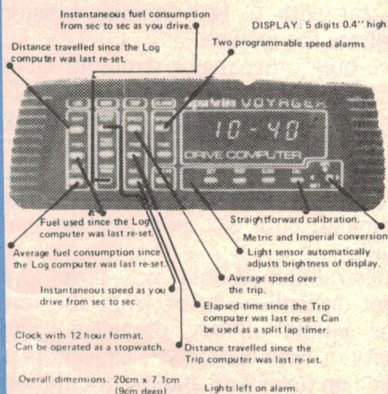
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PL30/20VA	\$14.75	PL12/40VA	\$16.50		
PL40/20VA	\$14.75	PL15/40VA	\$16.50	PL30/60VA	\$21.50
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Stock resistance values

50R 100R 200R	
500R 1K 2K 5K	
10K 20K 50K	
100K	

Spectrol model 534 - shaft	\$9.50
Price 1 9	
10 + values may be mixed	\$8.50

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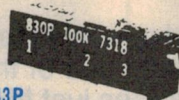
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### 20 TURN CERMET TRIM POT



### SPECTROL 43P ACTUAL SIZE

STOCK RESISTANCE VALUES  
10R 20R 50R 100R 200R 500R 1K  
2K 5K 10K 20K 50K 100K 200K  
500K 1M 2M

1-9	10-99	100+
\$1.40	\$1.30	\$1.00

Values may be mixed

### Hexadecimal Keypad \$42.50



19 key pad in cludes 1 10 keys ABCDEF and 2 optional keys and a shift key

Ideal for dream project

### MULTIDIALS



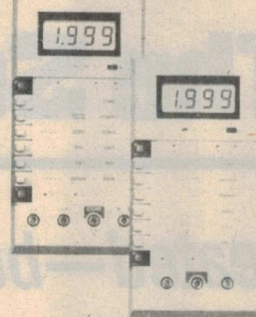
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Model 21 18 dia  
Model 16 9 dia  
Model 18 1 x 175 dia

\$24.50
\$19.50
\$27.50

### RS232 & "D" TYPE CONNECTORS

PART NO.	DESCRIPTION	1-9	10-25
DE 9P	9 PIN MALE	\$1.75	\$1.60
DE 9S	9 PIN FEMALE	2.25	2.10
DE 9C	9 PIN COVER	1.25	1.10
DA 15P	13 PIN MALE	1.10	1.05
DA 15S	15 PIN FEMALE	2.25	2.10
DA 15C	15 PIN COVER	1.15	1.05
DB 25P	25 PIN MALE	2.95	2.80
DB 25S	25 PIN FEMALE	3.45	3.30
DB 25C	1 pc Grey Hood	1.20	1.10
DB 25C2B	2 pc Black Hood	1.40	1.35
DB 25C2G	2 pc Grey Hood	1.35	1.25
DC 37P	37 PIN MALE	3.95	3.75
DC 37S	37 PIN FEMALE	5.45	4.95
DC 37C	37 PIN COVER	2.45	2.25
DH S	Hardware Set (2 Pairs)	1.05	0.95

## RITRON DIGITAL MULTIMETERS



### Q16010 specifications

1-4	5+
\$57.50	\$55.00

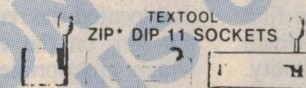
### Q17040 specifications

1-4	5+
\$87.50	\$83.50

- 28 Ranges
- Push Button Operation
- Auto Polarity
- Low Battery Indicator
- Full Overload Protection
- Finger Guards on Probes and Shrouded Plugs for Safety
- Accuracy: 1 year 18°C to 28°C (+ % of reading + No. of Digits) 200 hour battery life

Range	Resolution	Accuracy	Overload	Input Impedance	Power
200 mV	0.1	±0.5%	10A	10MΩ	0.5W
20V	0.1	±0.5%	10A	10MΩ	0.5W
200V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W

Range	Resolution	Accuracy	Overload	Input Impedance	Power
200 mV	0.1	±0.5%	10A	10MΩ	0.5W
20V	0.1	±0.5%	10A	10MΩ	0.5W
200V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W
1000V	0.1	±0.5%	10A	10MΩ	0.5W



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### DIP SWITCHES SPST

P.N.	No. of Switches	Price
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SD4	4	1.70
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SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

### DIP SWITCHES SPST



### cermet single TURN TRIM POT



Spectrol model 63P ACTUAL SIZE

STOCK VALUES  
10R 20R 50R 100R 200R 500R 1K  
2K 5K 10K 20K 50K 100K 200K 500K  
1M 2M

1 9	\$1.20
10 99	\$1.00
100	\$0.90

Values may be mixed.

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#### High Thermal Capacity Black Anodised

	1-4	5-9	10-49	50-99	499	1000
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HS2 - 75mm	3.00	2.90	2.50	2.00	2.00	1.50
HS3 - 150mm	5.80	5.40	4.90	3.80	2.90	2.70
HS4 - 225mm	8.10	7.60	7.10	5.90	4.50	4.30
HS5 - 300mm	8.90	8.40	7.90	6.50	4.90	4.60

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HS11 - 38mm	1.40	1.20	1.00	0.90	0.80	0.70
HS12 - 75mm	2.50	2.20	1.90	1.60	1.25	1.20
HS13 - 150mm	4.90	4.50	4.00	3.20	2.45	2.40

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TDK SAC60	1 for \$3.85	10 for \$34.10
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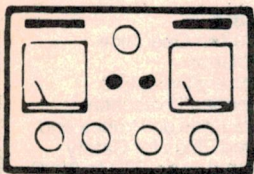
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# The Serviceman

## Somebody cheated—but who, why, and when?

For those who like a mystery, particularly a technical one, my main story this month should have a special appeal. It details one of the strangest faults I have ever encountered and emphasises just how impossible it is to predict the symptoms likely to be caused by any particular component failure.

The story started out in a fairly routine way, with no hint of the mystery that was to come. It involved a Rank Arena 2601 colour set; one of the first sets on the Australian market and which enjoys a high reputation for reliability. As it turned out, this set must have been one of the first off the production line and had enjoyed an almost trouble free life until now.

The owner is one of the local bank managers and the first news of the problem came to me via one of his neighbours, who happens to be a friend of mine. He is in the electronics industry himself, holds an amateur licence, and is well enough versed in TV to tackle minor repairs on his own equipment when necessary. On the other hand, he makes no claim to be a TV serviceman.

He became involved because the owner's wife asked him to look at the set, mainly to confirm what she felt was a loss of performance. More precisely, she felt that there didn't seem to be much green in the picture; something that was particularly noticeable when they were watching the cricket.

So my friend agreed to at least look and comment, imagining that a little tweaking might be all that was necessary. He certainly wasn't prepared for what he saw. To say that there wasn't much green in the picture turned out to be the understatement of all time; there wasn't any green, and the picture was almost pure magenta.

But that wasn't all. It transpired that the family had been looking at this nauseating excuse for colour for just on 12 months, apparently undecided as to whether there was something wrong or not. As my friend put it, one could only hope that the bank manager's ability to perceive and recognise colour was a lot better when it came to handling treasury notes.

Having recovered from this initial shock, my friend did exactly what I would have done; he removed the back and located the red, green, and blue output pins on the video out board, from which appropriate colour leads run to neck board and the picture tube cathodes. A check showed about 120V on these pins and, while he was not familiar with this model set, it seems like a reasonable figure, particularly as all three were the same.

Next he tackled the red, green and blue level controls on the neck board (VR901-2-3) to see whether he could lift the green level, but to no avail. Finally, he resorted to the old trick of unplugging the green lead from its pin on the video out board and shifting it to one of the other pins, to see whether he could produce any green, albeit false, from a known signal source. This also failed.

At his point my friend felt he had confirmed what he had originally suspected; a faulty picture tube. He also felt that he had delved as deeply as he wanted to, and that it was time to bow out. So he told the lady what he suspected and advised her to contact yours truly for final confirmation. In the meantime he passed this much of the story on to me.

### A terrible picture

Thus, in due course, I was formally approached by the owner and found myself face-to-face with the monster. And, even though I had been forewarned, the image it was producing came as quite a shock. I never cease to wonder at the horrible coloured images which supposedly intelligent people accept as colour TV. In many cases, a piece of coloured glass in front of a monochrome tube would serve them just as well!

At a more practical level I repeated the checks my friend had made, plus a few more voltage measurements, and quickly concluded that his diagnosis had been

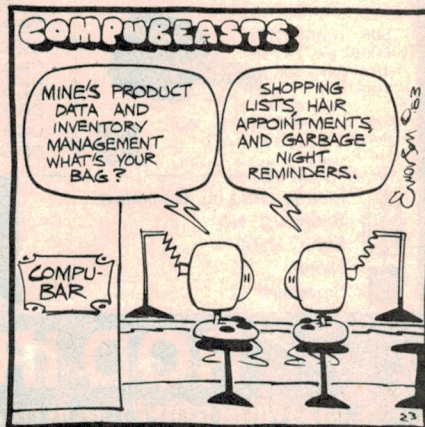
spot on; for some reason the green gun was no longer working and the only answer was to replace the tube.

Naturally, this was not something for a snap decision, particularly considering the age of the set. On the other hand, the set's history of reliability and the reputation of this model in general suggested that it could still be a proposition. I put the pros and cons of the situation to the lady, quoted a price for fitting a rebuilt tube, and left her to talk it over with her husband.

It didn't take them long to decide and the husband rang me the next day and asked me to go ahead with the job. Fortunately, I had a spare set on hand which I loaned them, hoping that, among other things, it might give them some idea of what a good colour TV image looked like. In the meantime I ordered a replacement tube.

This was duly delivered and I set about the routine job of fitting it and carrying out the necessary purity, convergence, and grey scale adjustments. Everything went smoothly until the last of these checks, when I became aware that the red saturation was poor; what should have been good solid reds were more orange than red.

The effect wasn't all that obvious; in fact it was quite subtle and I am sure that, had I returned the set to the owner, he would have been delighted with it. But I was convinced that something was wrong, and I was determined to find it.





I started by feeding a colour bar signal into the set and checking the output of the decoder board, PWC-296, with the CRO. The output of this board goes via a 5-pin plug, T1 to T5, back to the chroma board, PWC-411, thence to IC753, and out of this to a 3-pin plug, Y1 to Y3, carrying the B-Y, R-Y, and G-Y signals via a 3-core cable, appropriately colour coded, to the video out board.

The results of this check were not very conclusive, but they did seem to throw some suspicion on the decoder board, and I decided that the quickest way to prove the point was to change this latter. Fortunately, I had a set of replacement boards on hand and it was a simple job to change this one.

## What gives?

And that was where the fun began. The new board cured the saturation problems all right — the colour bar pattern confirmed that — but we now had green faces, orange grass, and all the horrible effects suggesting a chroma phase reversal. The colour bar pattern confirmed that also; fully saturated colours but in the wrong order.

That really set me back. The trouble was that I could not vouch for my stock decoder board. It was one I had salvaged from a junked set, and I had never bothered to check it. So did it have a fault in it?

While pondering this question I decided to also swap the chroma board, but this made no difference and seemingly cleared that part of the set. At this point I decided to put the monster aside for a few hours and get on with some more urgent and less troublesome jobs. In the meantime I could think about the problem and perhaps find some inspiration.

In the event that proved to be a wiser move than I had envisaged. A couple of hours later I received a call from another customer complaining that his set had lost colour completely and — yes, you've guessed it — it was a Rank 2601. It was a golden opportunity and I'll wager that that customer had never had quicker TV service in his life.

Naturally, I took along my full stock of replacement boards, including the untried decoder board, plus the decoder board from the other customer's set. The job itself was relatively easy; I suspected the chroma board and replacing it proved the point — instant colour.

Next I fitted the decoder board from the other customer's set. And this produced another shock; we now had transposed colours. I whipped it out quickly before the customer saw the effect and became suspicious.

Then I fitted my own stock decoder board. This produced correct colour, with full red saturation. I viewed these results with mixed feelings. On the one

hand they seemed to do more to confuse the situation than to clarify it. On the other hand, I had established two positive points: my own stock decoder board seemed to be cleared of any suspicion, and the customer's decoder board obviously had some kind of fault.

## Back at the ranch

Back at the workshop I tackled the customer's decoder board. I put it back in the set, fed in a colour bar signal, and set about making another lot of measurements and observations with the CRO, but with rather more care and precision than before.

And it paid off. I first confirmed that the R-Y signal was well down in level and then found the reason. Transformer T1003 in the collector circuit of the R-Y amplifier, TR1002, was the culprit, with its primary open circuit. Well, at least I had made some progress.

I didn't have a replacement transformer and, since the set had taken a violent dislike to my replacement board I compromised by using the transformer from my replacement board. This was duly fitted and the decoder board re-fitted to the set. This brought the signal level from the R-Y amplifier back to normal, but this was small consolation; the colours were still haywire.

At this point I was ready to give up. Nothing seemed to make sense. Why had this decoder board continued to produce some red, with colours all in the right order, when it had a major fault in it, yet would not work correctly when the fault was cleared? Or was it a decoder board fault at all, seeing that my own stock board, which would work in another set, also had the same effect? Was there a second fault somewhere?

It was the colour bar pattern on the screen which gave me the first clue. So far I had simply registered that the colours were in the wrong order, without paying too much attention to detail. Studying it in greater detail I realised that it was only the red and green which were wrong, being exactly transposed, while the blue was not effected.

So what would happen if I simply transposed the red and green leads on the video out pins? It took only a moment to try it and, lo and behold, a perfect picture; full red saturation and all the colours in their right place.

## Somebody's cheating

It would have been easy to leave it at that and get the thing off my back, and I was half tempted to do just that. But, having come this far I wanted to know what was going on. I was reminded of the old gag about the professional gambler who complained, "Somebody's cheating — they're not playing the cards I dealt 'em!"

# "HEY"

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## EDUCATION

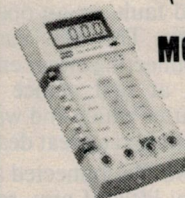
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I decided to back track, stage by stage if necessary, until I found the real cause. In fact, I didn't have far to look; no further than the 3-pin input plug to the video board, carrying the G-Y (pin Y3), R-Y (Y2), and B-Y (Y1) signals. As I mentioned earlier, these wires are colour coded green, red, and blue to conform to the above pin designations.

The simple explanation was that the G-Y and R-Y, or green and red leads, had been transposed inside the plug. But, just to make sure, I checked the identical 3-pin plug at the other end of the lead, where it joins the chroma board. If there was a similar error here I would be back to square one.

But there wasn't; it was correctly wired. So that explained that, even though it posed more questions that it answered. Why had the leads been transposed in the first place? And by whom? And when? (According to the owner, the set had never suffered from any fault involving transposed colours)? And why had the person responsible chosen to adopt the relatively difficult procedure of transposing the wires in the plug, rather than the easy way, using the leads from the neck board?

At this point in proceedings I was in no mood to even guess at the answers, even though a vague suspicion was forming in the back of my mind. All I wanted to do was get the set back to the owner, and I lost no time about it. Needless to say even he, with his limited appreciation of colour, was delighted with the result.

## Further tests

Later, I began to speculate more calmly about those questions and the vague suspicion became a more tangible theory. Thus it was that when I found myself confronted with another 2601 for a routine repair, I took the opportunity to make some further tests.

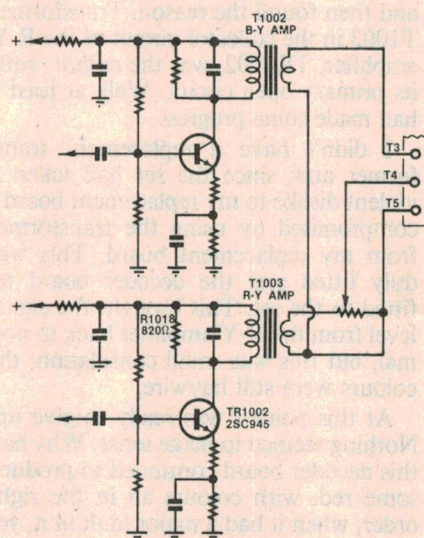
The main one was to simulate the original decoder board fault, ie, an open circuit T1003 primary. This was easy enough to do by disconnecting either end of the winding and, at first glance it would not seem to matter which end was involved. In fact, it mattered a great deal.

If the transformer was disconnected at the collector end, very little, if any, red signal was present in the secondary, but there was no suggestion of colour transposition. On the other hand, disconnecting the supply rail end produced a quite different result. The red, though still weak, was a good deal stronger and, most important, the red and green were now transposed.

By way of explanation I offer the

following suggestion. With the transformer winding open at the supply rail end, it would be possible for the stage to function as a crude resistance/capacitance coupled amplifier, the 820Ω resistor in parallel with the primary serving as the collector load, and the capacitance between primary and secondary windings as the coupling capacitor.

Granted, the effectiveness of such a circuit would be poor (hence the desaturated red), but still apparently good



Portion of the decoder circuit. With T1003 primary open, the stage could function as a crude R/C amplifier.

enough to satisfy the non-critical observer. But what about the phase of such a signal? One can only speculate because the correct phase would be determined by the windings and connections to the transformer. However, I suggest that it was more or less opposite to the correct phase, thus playing havoc with the whole red/green phase relationship.

## A possible answer

And so we have a possible answer as to why the leads to the video out board had been deliberately transposed. The transformer had failed, transposing the red and green, and someone had taken the easy way out by swapping pin connections. But who? And when?

I hesitate to say this, but I strongly suspect that it happened in the factory. I suggest that someone noticed the reversed red and green, assumed that it was a simple cable fault, and swapped the pins over. And, in the rush to get sets on the market at that stage, it would have been quite easy for the weak red to be overlooked.

And why swap these leads rather than the easier ones from the neck board? Either because they genuinely believed that that was where the fault was, or because they realised they were doing the wrong thing and didn't want the trick to be discovered. Had they swapped the neck board leads there would be a good chance of someone spotting the switch and asking awkward questions.

Alternatively, could it have been the dealer who sold the set who, finding himself with a faulty set from the factory, and anxious not to break a promised delivery date, pulled a swifty? But, if so, why would he swap the plug pins rather than the neck board leads?

The plug pins are not easy to extract, being held in with a spring barb. Without the proper tool they are almost impossible to extract without mutilating them or at least leaving some evidence. I was very careful when I extracted the transposed pins and paid particular attention to their condition. There was not the slightest sign of butchery.

So there it is; a mystery in both the purely technical sense and a historical one as well. I think I have provided at least a partial explanation for the purely technical problem, but there is little chance that the real story behind it will ever be told. But I wonder whether anyone else has ever encountered anything like it?

## Alminox

To finish off this month, here is a brief comment following my story in the April issue concerning TV reception problems on a fishing trawler. In that I touched on the very serious problem of corrosion as encountered by TV and other antennas when used at sea, or even in seaside suburbs.

In so doing I mentioned a product called "Alminox" which had been tried on the shipboard environment, and which had stood up to some two years of extremely harsh conditions with virtually no signs of corrosion where it was used. Following this I have received some enquiries via the EA office from readers wanting to know more about it and where it can be obtained.

Information is available from the manufacturers, Electrical Equipment Ltd, 51 Bassett St, Mona Vale, NSW, 2103. Their phone number is (02) 997 3433. I am sure they will be happy to forward descriptive literature to anyone who is interested.

Incidentally, I understand that the amateur fraternity, who are always mucking about with antennas in various forms, have welcomed the product with open arms, as a solution to the many water sealing problems which such experiments create.



## 5000 POWER AMPLIFIER

### "BLACK MONOLITH"

REF. ETI JAN/MARCH 1981



In "2001" Arthur C. Clarke's Black Monolith symbolised awesome power - intelligence.

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★ Completely redesigned flag heatsinks for the Driver Transistors. Thoroughly endorsed by David Tillbrook. (The original ones were so small if the bias current was set high for low distortion).

★ Ventilation grilles in the covers. These were not included in the original design.

★ Blind tapped holes in the exclusive "Superfinish" front panel. Heavy gauge screws used for stronger connection of the heatsink bracket to the panel.

★ Jig drilled, EXTRUDED, deburred and black anodised heatsink bracket in heavy gauge. All other kits we have seen, a flimsy punched out piece of sheet metal is supplied. Not even anodised! This is one of the most critical components in the kit.

★ Beryllium Oxide heatsink washers supplied. A tube of heatsink compound is also supplied - with enough left over to use elsewhere.

★ "Superfinish" Front Panel. Despite what others may claim ours is still the best.

★ Dual 3 pin DIN 30V Power Outlets. This extra power outlet enables you to power extra 5000 series components as they arrive on the scene.

★ And all of the extra features of our normal Superfinish 5000 amp, like: Metal 1% film resistors, Prewound chokes, Fibreglass PCB's, Heavy duty earth braid, Quality capacitors, Original chassis-bar design, Flux shorting straps on the transformers etc, etc.

The Jaycar "BLACK MONOLITH" is worth far more than the inferior kits around the market today. However, in some cases, it costs more!

Remember you only get out of a product what you put in to it and the performance of Jaycar kits is measured - IN RESULTS.

### COMPLETE "BLACK MONOLITH" KIT ONLY

Cat. KE-4200

**\$319.00**

### ETI 733 RTTY DECODER

REF. ETI APRIL 1983

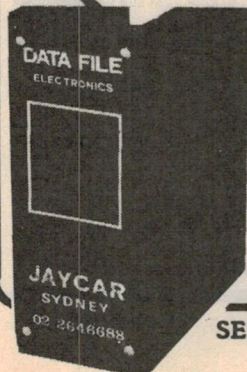
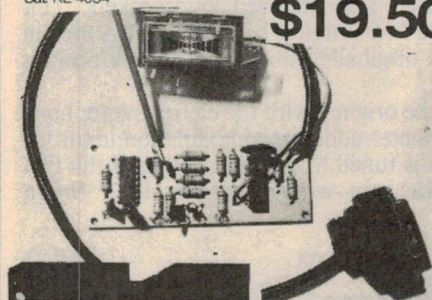
This simple project allows you to hook up your MicroBee to a communications receiver (or a similar good quality receiver) and print radioteletype messages on your VDU screen. A simple bit of software does the decoding. The kit can be adapted for use on other Z80 based systems.

The Jaycar kit includes box, centre-zero meter, DB15 plug and software listing as well as other kit instructions.

A bargain and simple to build!

Cat. KE-4654

**\$19.50**



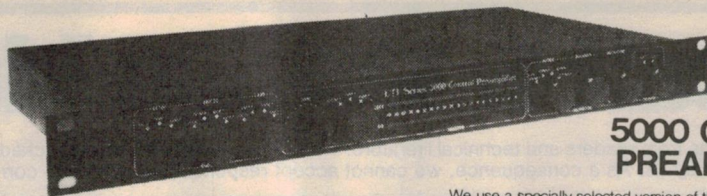
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## 5000 CONTROL PREAMPLIFIER

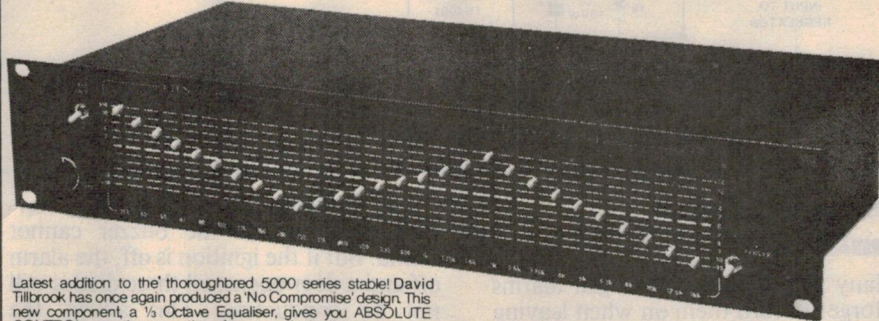
### "BLUEPRINT"

REF. ETI JUNE/OCTOBER 1981

The refinement to this preamp has been incredible. At one stage we had two versions of the preamp but people were only interested in the Blueprint.

Why is the Blueprint so good? Well, there are many reasons but a few of the main ones: Firstly, we use a far, far superior screened cable in the kit. It is much lower in capacitance than the cheap imported excuse for screened cable found in ALL other versions that we have seen. This cable is made in Australia especially for us and costs over 5 times more than the imported junk. When you consider that over THIRTY FEET of screened cable runs around inside the preamp you will appreciate the low capacitance cable. High capacitance cable in signal lines could effect high frequency performance.

### 1/3 OCTAVE EQUALISER



Latest addition to the 'thoroughbred' 5000 series stable! David Tillbrook has once again produced a 'No Compromise' design. This new component, a 1/3 Octave Equaliser, gives you ABSOLUTE CONTROL over the acoustics of your particular listening environment. You get 3 SEPARATE CONTROLS for each and every octave of audio bandwidth to virtually eliminate the subtle nuances that are particular to your listening area.

1/3 Octave Equalisers have been used by professional engineers in Recording Studios and live concerts for over a decade now. It is no accident that the advent of the 1/3 octave equaliser and studio quality live sound recording have gone hand in hand.

### BUT FOR YOU THERE'S A CATCH!!

For Hi Fi stereo one of these units is not enough. They are mono so you will need one for each channel. Quite a lot of money really, but worth it if you want the best. Remember that whilst this unit is designed to operate in the 5000 system it will work with other Hi Fi equipment, line level in, line level out.

The Jaycar kit includes a fully pre-punched plated chassis, pre-punched heavy gauge front panel silk-screened to match the other 500 components. It is absolutely original but includes such refinements as quality I.C. sockets, UNBRAKO socket head fixing screws, and brushless-look toggle switches.

You can purchase the kits one at a time at \$199 each or, two, \$389 - a \$10 saving.

If you are one of the hundreds of happy 5000 users we are convinced that you will be just delighted with this unit.

Cat. KE-4204

### ETI 674 MICROBEE PROPORTIONAL ANALOGUE JOYSTICK

REF. ETI DECEMBER 1983

Most computers offer joysticks as options but most aren't as sophisticated as this one. Your average joystick or games controller, is nothing more than four switches. This means that you can only go "full on" or "full off" in any direction.

NOW consider the 674. Whilst this LOOKS the same as other joysticks, you can for example move the stick say, 24 degrees from 12 o'clock (or North). The dot or object will follow EXACTLY. If you move quickly, the dot moves quickly. If you move the stick slowly the dot just CREEPS along! You can even write your name with the dot! Once again, the project is designed specifically for the MicroBee which Jaycar supports as a computer dealer.

The kit comes complete with software listing, high quality self centering joystick and jiffy case.

Cat. KE-4674

Beware of apparently cheaper kits that do not have self centering joysticks.

**\$35**

2. Deluxe kit. Includes all of the above PLUS 3 extra "Personality" plugs, case with front panel and mains transformer, fuse, 240V plug etc. Also included are two sockets with extra long pins so that they can mount flush with front panel as well as extra components for 2764 programming.

Cat. KE-4651

**\$55**

We use a specially selected version of the LM394 ultra-matched transistor for the moving coil preamp. We employ HARD (not soft gold plated) RCA input sockets on ALL INPUTS (previously just M.C.). Probably a bit extravagant (except M.C.), we think, but nice. A pair of solid metal, gold plated RCA line sockets are provided to connect to your M.C. cartridge. Special Nylon mounting grommets are provided for all input and output sockets. Far superior to squishy and perishable rubber grommets provided in other kits. Extra touches like roller-tinned PCBs (to reduce dry or noisy solder joints), 1% metal film resistors, quality I.C. sockets where practicable, low noise selector switches, special rear panel, solid machined matching Aluminium knobs and specially polished rectangular (multicoloured) LEDs add up to a classis kit.

Like the Black Monolith the Blueprint is the intelligent choice. Even if you were a millionaire and could afford anything you probably would do no better spending virtually any amount of money more.

### THE BLUEPRINT IS UNBELIEVABLE VALUE FOR MONEY AT ONLY

**\$299**

FOR THE COMPLETE KIT

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SIGNAL TO NOISE  
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-102dB with respect to 1 Volt

12Hz - 105kHz to -1dB

14dB (28dB total)

100Hz - 0.007%

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(essentially irrespective of cut or boost)

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### ETI 668 uBEE EPROM PROGRAMMER

REF. ETI FEBRUARY 1983

This simple, low cost unit just plugs into the MicroBees I/O port and enables you to save programs in any of 5 different EPROMs (2716, 2732, 2532, 2732A & 2764), which can be used in your MicroBee or any other microprocessor based system. As your MicroBee I/O port is effected with a Z80 PIO chip, this programmer can be used with any other system employing the same I/O.

Jaycar has two versions of this kit.  
1. Lowest possible cost shortform. Includes 2 x "Personality" plugs, 28 pin IC socket (as well as sockets for other IC's) Cannon DB15 plug, wire etc.

Cat. KE-4650

**Jaycar ELECTRONICS**



# Circuit & Design Ideas

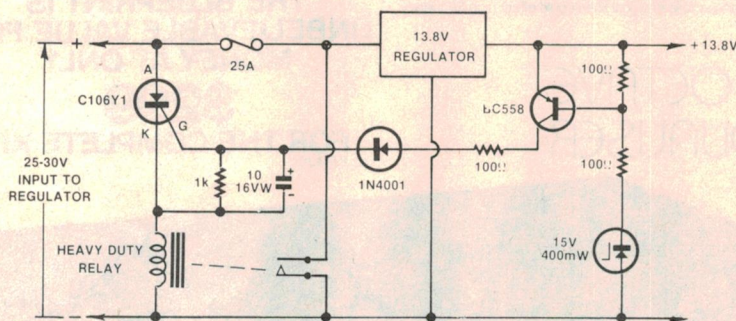
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

## Crowbar protection for 13.8V supplies

The VK Powermaster 13.8V 25-amp supply featured in the March 1984 issue did not have any over-voltage protection. This could lead to expensive damage to a

transceiver in the event of a power supply fault. The only effective way to protect an external load is to install crowbar protection. This shorts the supply output and blows the fuse in the event of the output voltage exceeding 15V.

The circuit is based on that featured



with the 5V/10A Mini-brute supply published in the November 1977 issue. It works as follows: The circuit monitors the 13.8V output of the supply and if the voltage rises above 15V (depending on the tolerance of the zener diode) it trips an SCR. This energises a heavy duty relay which then blows a 15 amp fuse in series with the unregulated input to the regulated supply.

Since the SCR runs from the unregulated supply line ahead of the fuse the relay remains energised until the power is removed.

A suitable headlamp relay is available from Dick Smith Electronics (cat No. S-7304). We suggest the use of 15-amp fuse wire (not 25-amp) in a 30-amp 250VAC fuseholder.

"Electronics Australia" staff.

## Burglar alarm reminder

Many people have car burglar alarms but forget to turn them on when leaving the vehicle. This circuit turns on a buzzer as a reminder. It is basically a diode OR-gate monitoring the ignition, the door courtesy light switches and the main supply to the burglar alarm. (The circuit would be quite suitable as an add-on to the EA alarm).

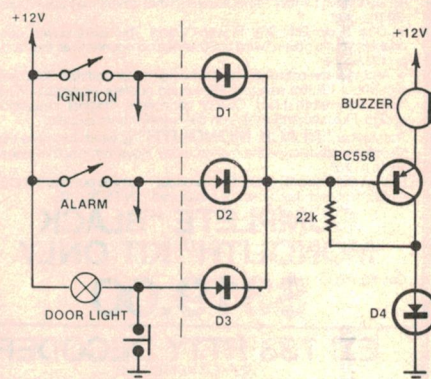
When any of the diodes D1, D2 or D3

is conducting, the base of the BC558 is held high and so the buzzer cannot sound. But if the ignition is off, the alarm off and a door opens, all three diodes will not be conducting. This allows the BC558 to turn on and sound the buzzer. D4 merely protects the transistor in case the supply is wrongly connected at installation.

The buzzer should be a piezoelectric type with inbuilt oscillator.

M. Cameron,  
Glen Waverley, Vic.

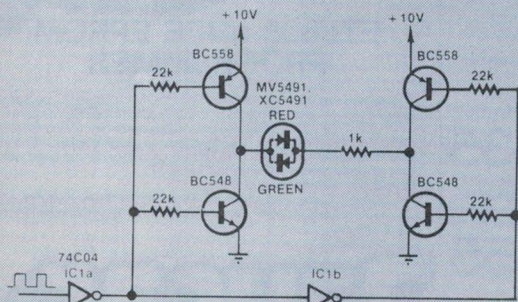
**\$10**



## Bi-colour LED gives varying hue

By varying the duty cycle of the input pulses to this circuit, a bi-colour LED may be made to deliver a range of four colours from green through to red. For example, a duty cycle of less than 20% gives green; around 50%, yellow; around 80%, orange and more than 90%, red.

From "Electronics", August 1979.



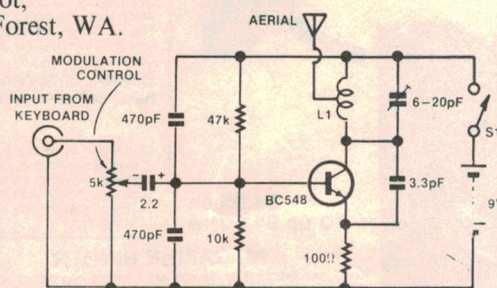
## Wireless link for musical keyboard

Battery operated musical keyboards are far more satisfying to listen to via a stereo amplifier and full-sized loudspeakers. This circuit is an adaptation of the FM Wireless Microphone featured in EA in December 1980 and originally published in "Dick Smith's Fun Way", Volume 2.

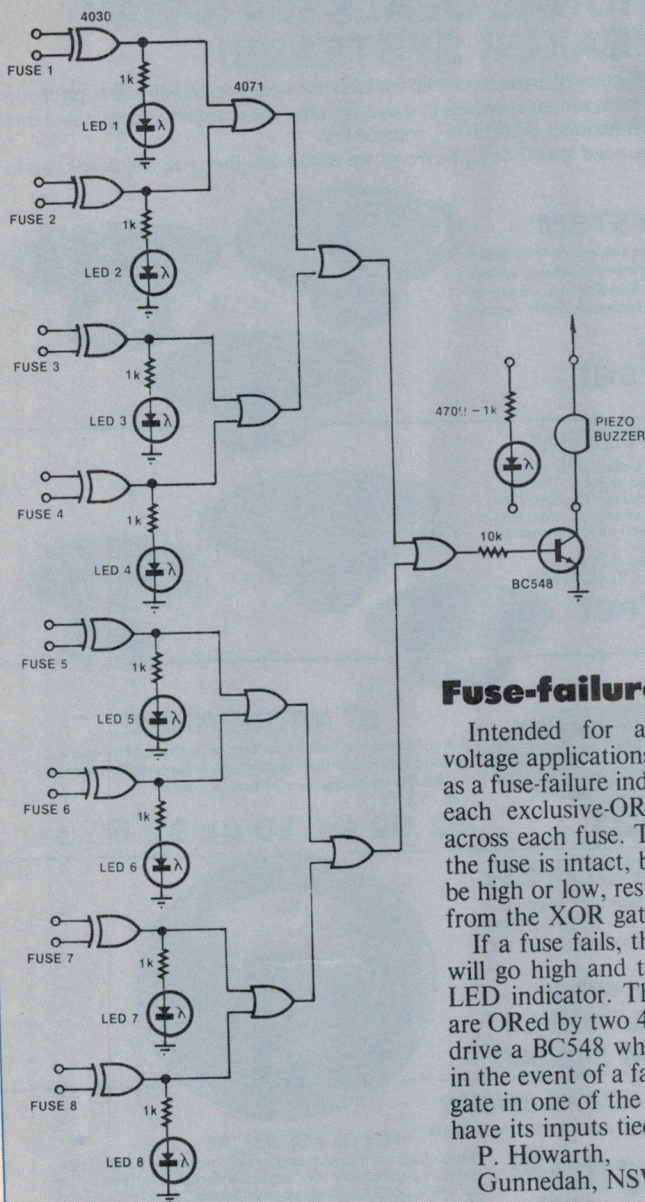
Essentially, the circuit is the original with the electret microphone omitted and a 5k $\Omega$  potentiometer added as a modulation input for the oscillator. The oscillator is tuned to a blank portion of the FM band, 88 to 108MHz. Kits are available from Dick Smith Electronics.

A. Elliot,  
Glen Forest, WA.

**\$10**







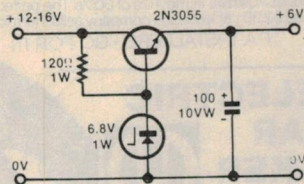
### Fuse-failure indicator

Intended for automotive and low voltage applications, this circuit operates as a fuse-failure indicator. Both inputs of each exclusive-OR gate are connected across each fuse. This means that when the fuse is intact, both inputs will either be high or low, resulting in a low output from the XOR gate.

If a fuse fails, the relevant XOR gate will go high and turn on the associated LED indicator. The XOR gate outputs are ORed by two 4071 quad OR gates to drive a BC548 which energises a buzzer in the event of a failure. The unused OR gate in one of the 4071 packages should have its inputs tied low.

P. Howarth,  
Gunnedah, NSW.

**\$15**



### 6V Car Adaptor

The requirement for a 6V supply in a car with a 12V battery is easily met with this simple discrete-component circuit. Q1 is an emitter-follower with a 6.8V reference provided by the one-watt zener diode. The base-emitter voltage of Q1 is subtracted from the reference to give a nominal output of 6.1 volts.

The 120Ω resistor feeding the zener diode limits the current available to the

base of Q1 and thus sets the regulation performance. It also renders Q1 proof against momentary short circuits. Q1 will deliver about one amp or so and should be mounted on a suitable heatsink.

M. Sully,  
Keilor Downs, Vic.

**\$10**

### Wanted: your brain-waves

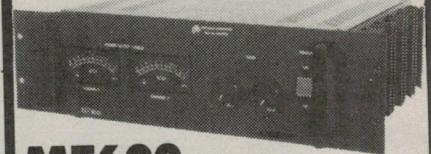
Come on now. You must have had some bright circuit and design ideas which are worth publishing. Why not send them in and make a little extra brass for more electronic components? We pay between \$5 and \$40 per item published, depending on the merit and the amount of work we have to do to publish it.



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Superb 8" woofer with foam surround suspension and heavy magnet assembly with sealed back midrange and tweeter. System impedance 8 ohms. Power handling 40 watts rms. Crossover capacitors and connecting diagram and recommended 8" cabinet detail drawing supplied.

Cat. CS-2453 (2 required for stereo)

**\$29.95/set**

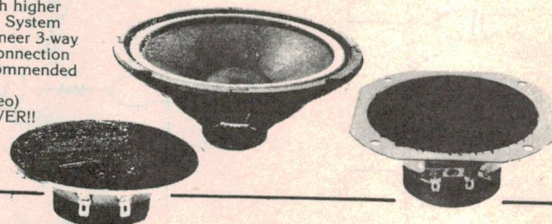


### 10" 3 WAY SYSTEM

Once again, a high quality 10" woofer with higher power, sealed back midrange and tweeter. System impedance 8 ohms. In addition a quality Pioneer 3-way crossover is provided at no extra charge. Connection instructions are also provided as well as recommended 10" cabinet plans.

Cat. CS-2454 (2 required for stereo)  
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4 ohm impedance. Suitable for cars, or two in a box for external speaker system. Very high quality curvilinear cone. Normally sells for \$6.95 each. Less than 1/2 normal cost!

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**\$2.99 ea 10 up \$2.50 ea**



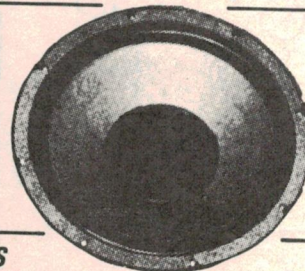
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We have made a MASSIVE SCOOP purchase of genuine quality PHILIPS European made 12" HI FI woofers. These are used in the fabulous ETI4000 series kits. 100 watts rms power handling.

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**TAKES STANDARD  
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**8" TWIN-  
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20 watts rms with whizzer cone. Air suspension type. Low free air resonance.

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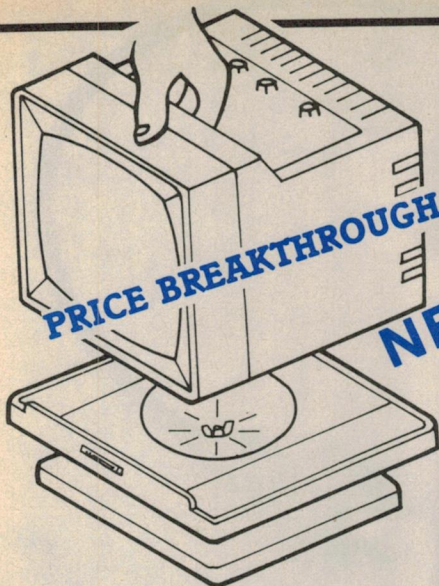
Quality Pioneer brand - check the specs! Check the price!!  
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Sensitivity	98(dB/W)
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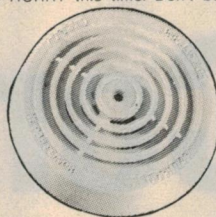
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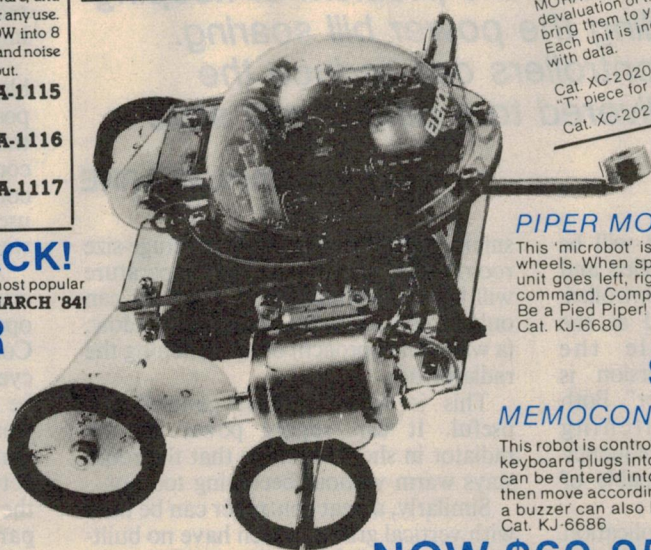
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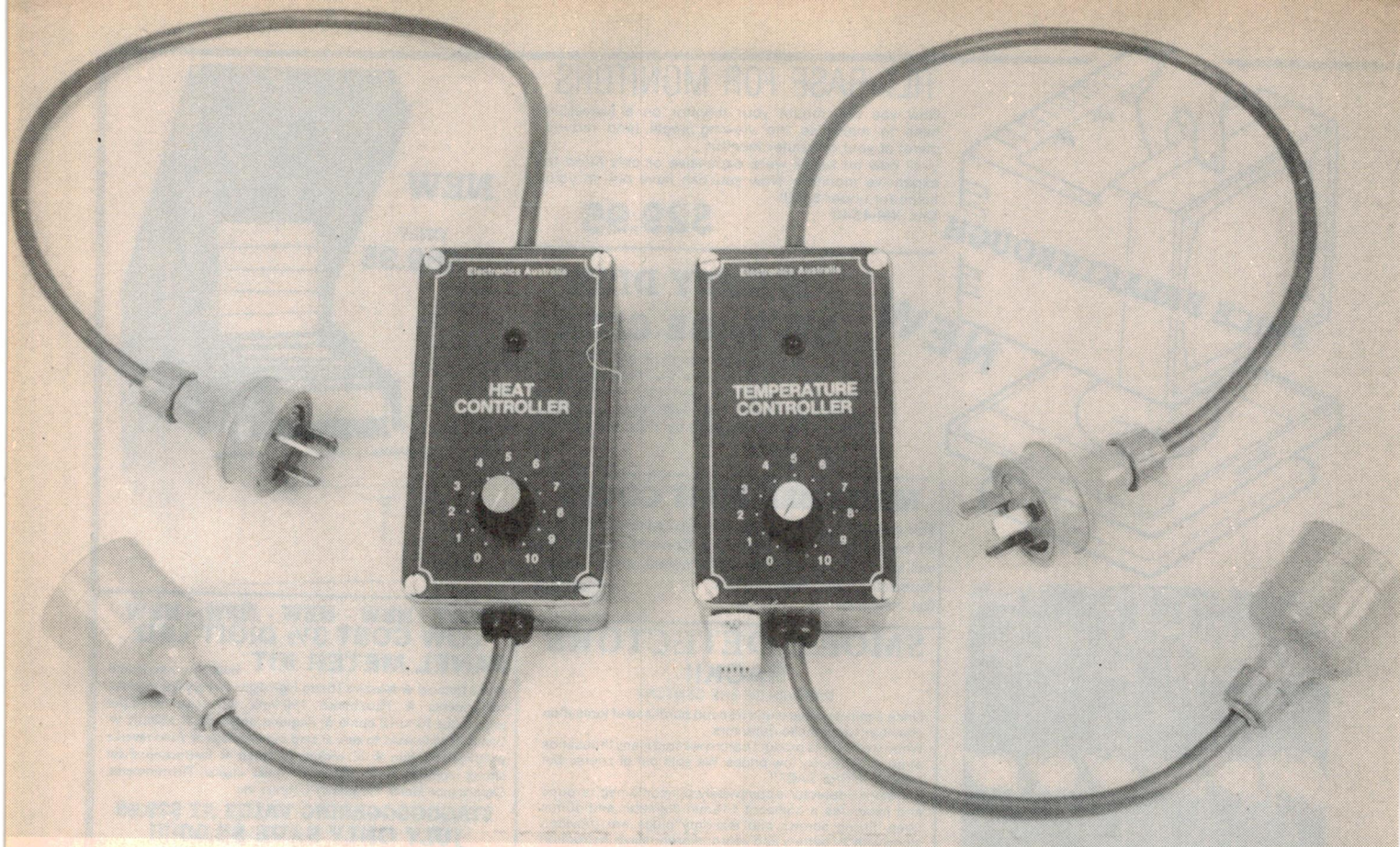
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# Save power: build these Heat Controllers

*Winter is here and with it the problem of keeping warm without sending the power bill soaring. These new heat controllers can reduce the average power delivered to a heater and save you money.*

by JOHN CLARKE

Two versions of this project will be described, one manually controlled and the other thermostatically controlled. The first version is designated as the "Heat Controller" while the thermostatically controlled version is called a "Temperature Controller". Both employ zero-voltage switching techniques to minimise radio frequency interference (RFI), and are capable of controlling loads up to 1200W.

By far the most common application for heat controllers is with using electric radiators. Place a bar radiator, even a

small 1000W type, in an average-size room and in a short time the temperature will become stifflingly hot. The heat can only be controlled by opening a window, (a wasteful approach) or by switching the radiator off.

This is where a heat controller is useful. It can supply power to the radiator in short bursts so that the room stays warm without becoming too hot.

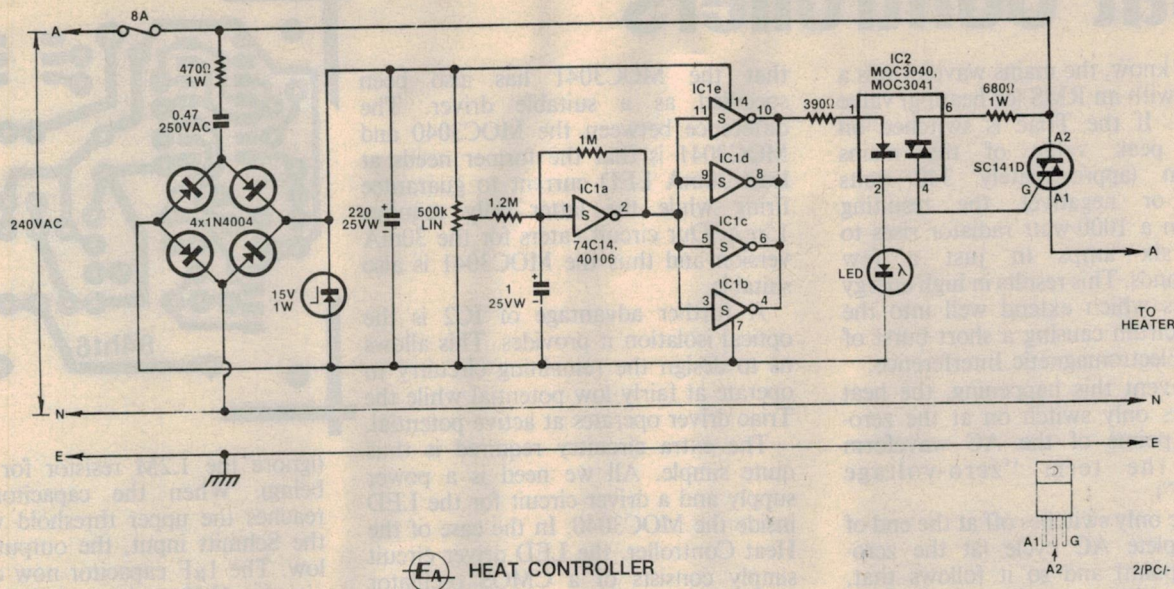
Similarly, a heat controller can be used with vertical grillers which have no built-in heat control. Normally, the only way the cooking temperature of these can be

controlled is to open the side covers to release the heat — a very wasteful and imprecise method.

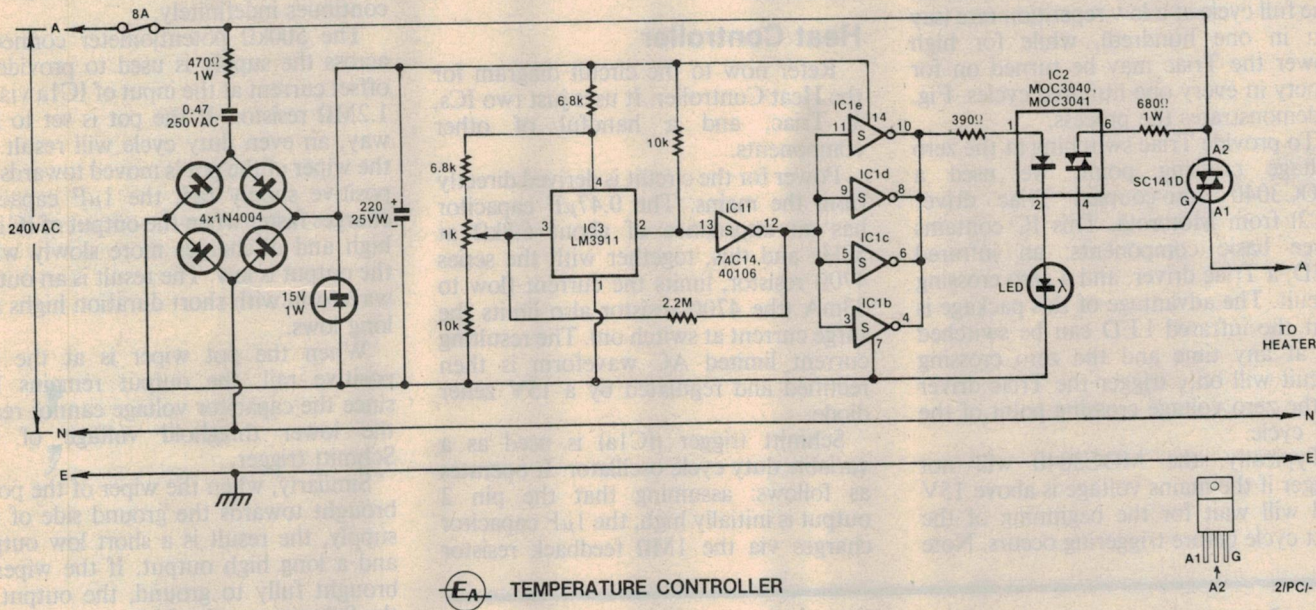
Then there are the many electric blankets which only have coarse three-position control. No matter what you do, the setting is always either too hot or too cool. A heat controller can provide a continuously variable setting so that the user can select just the right amount of warmth.

Although the two units employ similar circuits, they differ somewhat in their operation. The manual version (the Heat Controller) simply controls the duty cycle of "heat-on" to "heat-off". This can be adjusted using a rotary control knob from fully on to fully off, with continuously variable heat settings between these two extremes. Obviously, the setting does not directly relate to a particular temperature but to a percentage of the total power supplied to the heater.





Above: circuit diagram for the Heat Controller. It controls the heat by switching a Triac on and off at a preset duty cycle.



The Temperature Controller. IC3 switches the Triac on or off according to room temperature.

While the Heat Controller is suitable for all of the above applications, the Temperature Controller is the more practical for room temperature control. Basically, it automatically controls the radiator so that the temperature is kept to within a few degrees of a preset level. It does this by switching off the supply when the temperature reaches a preset level. When the room cools, it switches the radiator on again.

Similarly, the Temperature Controller can also be used to automatically switch on an electric blanket should the room temperature drop below a preset level, or off if the room temperature rises.

Physically, each unit is an in-line device housed in a small metal diecast case. Mains leads exit from each end of the case and are fitted with a three pin plug on one lead and a socket on the other. A knob on the lid provides the temperature control while a LED indicates whether the heater is switched on or off.

The Temperature Controller also has a small plastic housing mounted on one end of the case. This encloses an LM3911 temperature controller IC and serves to expose the IC, which is potentially at mains voltage, to the ambient air. At the same time, it isolates

the IC from the case and this is important since the latter is prone to heating by the control circuitry.

### How it works

Basically, both units contain a Triac, which can be considered as an electronic switch, and this is triggered to power the heater. In the case of the Heat Controller, the Triac is switched on and off at a preset duty cycle while the Temperature Controller switches the Triac on when the temperature is below a set level and off when the temperature rises above this level (although there is some hysteresis).



# Heat Controllers

As we know, the mains waveform is a sinusoid with an RMS (or heating) value of 250V. If the Triac is switched on at the peak value of the mains waveform (approximately 340 volts positive or negative), the resulting current in a 1000-watt radiator rises to almost six amps in just a few microseconds. This results in high energy harmonics which extend well into the radio spectrum causing a short burst of EMI or Electromagnetic Interference.

To prevent this happening, the heat controllers only switch on at the zero-crossing points of the AC waveform (hence the term "zero-voltage switching").

A Triac only switches off at the end of one complete AC cycle (at the zero-crossing point) and so it follows that, with zero voltage switching, the Triac is turned on for integral numbers of AC cycles. When the Heat Controller is set to low power, the Triac is turned on for one full cycle at a low repetition rate (say ten in one hundred), while for high power the Triac may be turned on for ninety in every one hundred cycles. Fig. 1 demonstrates the process.

To provide Triac switching at the zero voltage crossing point, we used a MOC3040 opto-coupled Triac driver (IC2) from Motorola. This IC contains three basic components: an infrared LED, a Triac driver, and a zero crossing circuit. The advantage of this package is that the infrared LED can be switched on at any time and the zero crossing circuit will only trigger the Triac driver at the zero voltage crossing point of the AC cycle.

Typically, the MOC3040 will not trigger if the mains voltage is above 15V and will wait for the beginning of the next cycle before triggering occurs. Note

that the MOC3041 has also been specified as a suitable driver. The difference between the MOC3040 and MOC3041 is that the former needs at least 30mA LED current to guarantee firing while the latter only requires 15mA. Our circuit caters for the 30mA version and thus the MOC3041 is also suitable.

A further advantage of IC2 is the optical isolation it provides. This allows us to design the remaining circuitry to operate at fairly low potential while the Triac driver operates at active potential.

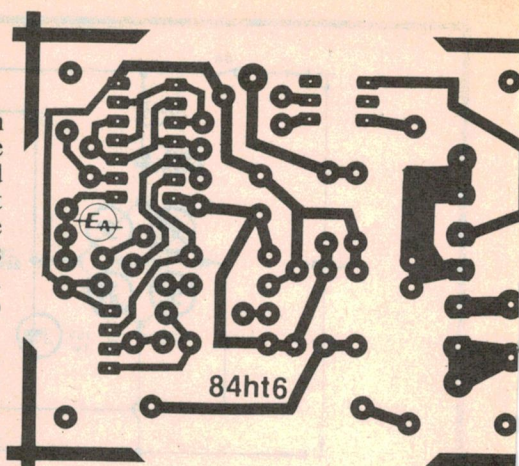
The extra circuitry required is thus quite simple. All we need is a power supply and a driver circuit for the LED inside the MOC3040. In the case of the Heat Controller, the LED driver circuit simply consists of a CMOS oscillator with an adjustable duty cycle. In the case of the Temperature controller, the driver circuit consists of a single temperature control IC.

## Heat Controller

Refer now to the circuit diagram for the Heat Controller. It uses just two ICs, a Triac, and a handful of other components.

Power for the circuit is derived directly from the mains. The  $0.47\mu\text{F}$  capacitor has an impedance of about  $6.8\text{k}\Omega$  at 50Hz and this, together with the series  $470\Omega$  resistor, limits the current flow to 33mA (the  $470\Omega$  resistor also limits the surge current at switch on). The resulting current limited AC waveform is then rectified and regulated by a 15V zener diode.

Schmitt trigger (IC1a) is used as a variable duty cycle oscillator. It operates as follows: assuming that the pin 2 output is initially high, the  $1\mu\text{F}$  capacitor charges via the  $1\text{M}\Omega$  feedback resistor



(ignore the  $1.2\text{M}$  resistor for the time being). When the capacitor voltage reaches the upper threshold voltage of the Schmitt input, the output switches low. The  $1\mu\text{F}$  capacitor now discharges via the  $1\text{M}\Omega$  resistor until its voltage reaches the lower threshold of the Schmitt input, at which point the output switches high again and thus the process continues indefinitely.

The  $500\text{k}\Omega$  potentiometer connected across the supply is used to provide an offset current at the input of IC1a via the  $1.2\text{M}\Omega$  resistor. If the pot is set to half way, an even duty cycle will result. As the wiper of the pot is moved towards the positive supply rail, the  $1\mu\text{F}$  capacitor charges faster when the output of IC1a is high and discharges more slowly when the output is low. The result is an output waveform with short duration highs and long lows.

When the pot wiper is at the full positive rail, the output remains low since the capacitor voltage cannot reach the lower threshold voltage of the Schmitt trigger.

Similarly, when the wiper of the pot is brought towards the ground side of the supply, the result is a short low output and a long high output. If the wiper is brought fully to ground, the output of the Schmitt remains high.

The  $500\text{k}\Omega$  potentiometer therefore varies the oscillator duty cycle and provides a range between a permanently high Schmitt trigger output to a permanently low output.

The output of the Schmitt trigger oscillator is buffered by paralleled Schmitt inverters IC1b-IC1e, which together supply the necessary 30mA LED current for the MOC3040. An external LED connected in series with the MOC3040 LED indicates when the IC is firing the Triac.

When the Triac driver is activated, current flows between the gate and A2 of the mains switching Triac (SC141D) via a  $680\Omega$  1W resistor. A 1W resistor is necessary for its 400V rating, although the actual dissipation is less than  $\frac{1}{4}\text{W}$ .

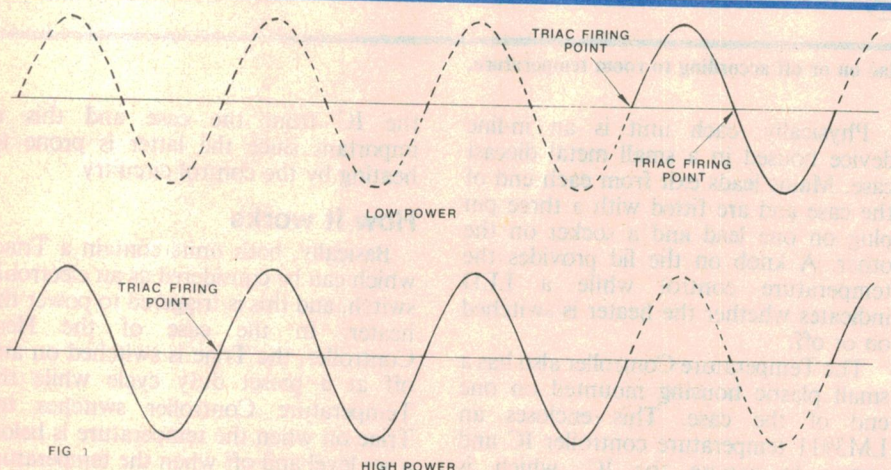


FIG 1  
How zero-voltage switching works. The Triac turns on and off at the zero-voltage crossing points.



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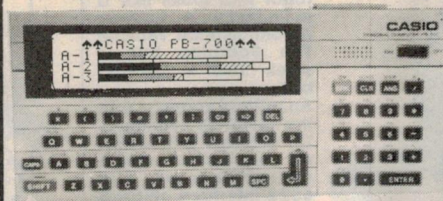
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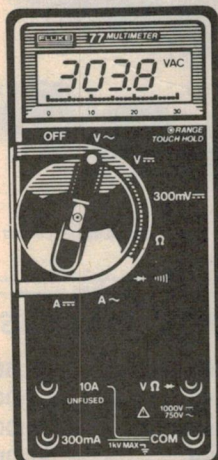
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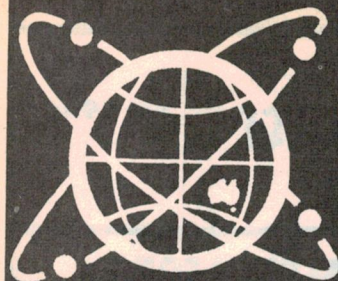
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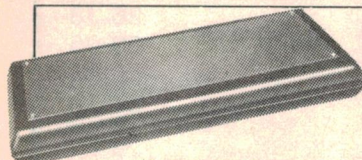
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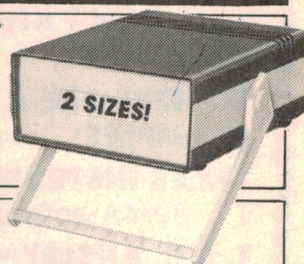
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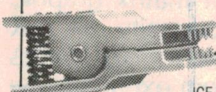


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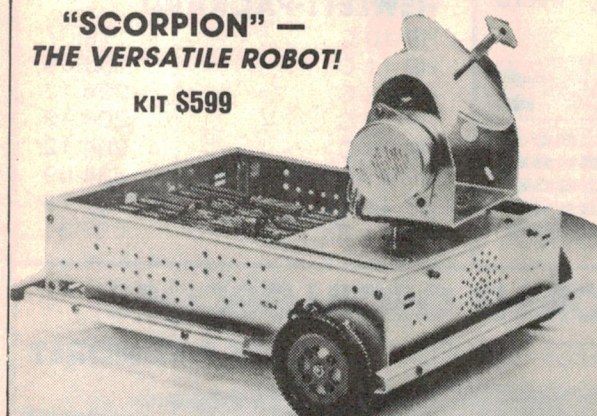
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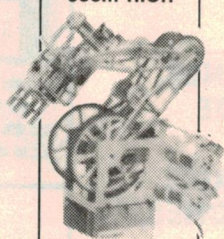


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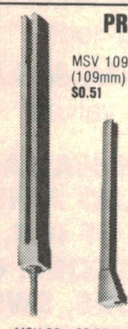
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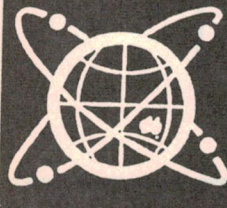
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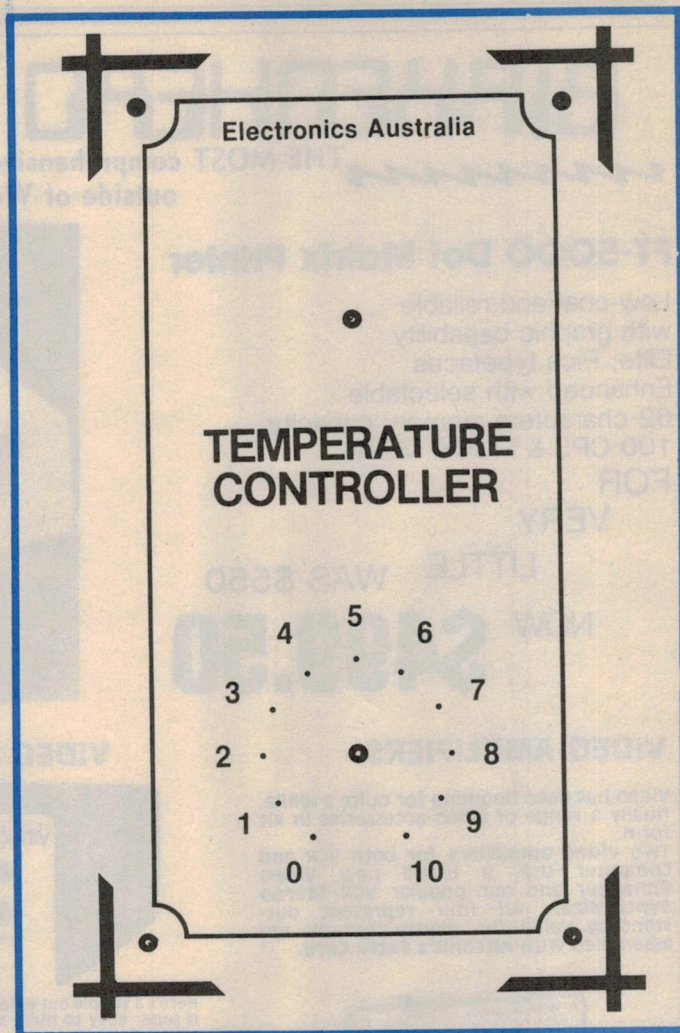
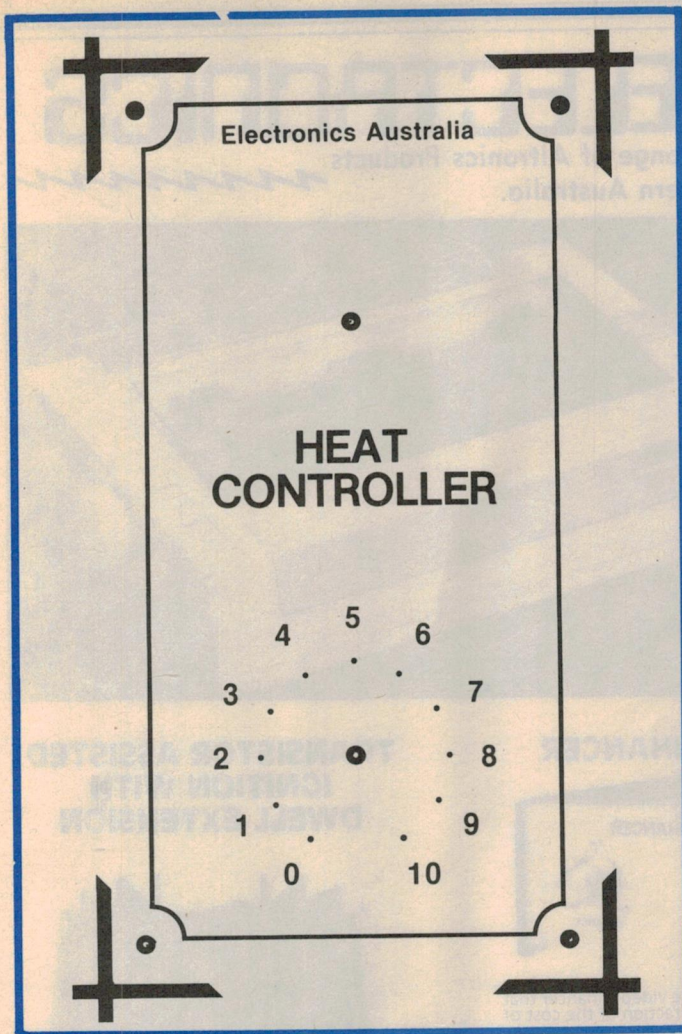
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## Heat Controllers

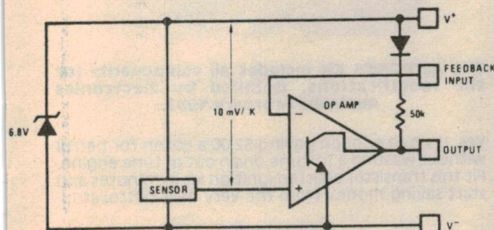


Fig. 2: block diagram of the LM3911 temperature controller IC.

### Temperature Controller

The Temperature Controller circuit incorporates most of the circuitry of the Heat Controller, the main exception being the Schmitt trigger oscillator. The additional circuitry comprises inverter IC1f, temperature controller IC3, and a few associated components.

IC3 is a National Semiconductor temperature controller IC designated the LM3911. It supplies an output voltage of 10mV/degree Kelvin. Internally, it consists of a temperature sensor, an operational amplifier and a stable voltage reference (see Fig. 2). The internal op

amp is used as a comparator which changes state when the temperature reaches a preset point.

The voltage at the input, pin 3, determines the temperature at which the comparator changes state. If the voltage at pin 3 is 2.73V negative with respect to pin 4, then the comparator output will be low for temperatures above 0°C and high for temperatures below this. For each 10mV change on pin 3, the triggering point for the comparator changes by 1°C. For example, 2.98V on pin 3 will switch the comparator at 25°C.

A 1kΩ potentiometer is used to vary the voltage on pin 3 (so that the temperature can be set), while the 6.8kΩ and 10kΩ resistors limit the voltage swing from about 2.66 to 3.13V. The 6.8kΩ resistor from pin 4 to the 15V supply is for current limiting the internal voltage reference.

The comparator output is open collector and so a 10kΩ resistor is necessary to pull up the output to the full 15V rail when pin 2 is high. IC1f inverts

the comparator output to provide the correct logic sense while the 2.2MΩ feedback resistor provides a small amount (about 4°C) of hysteresis. This is necessary to prevent oscillation at the trigger point and means that, in practice, the temperature will vary over a 4°C range.

The remainder of the circuit functions in exactly the same manner as the Heat Controller, with the output of IC1f driving buffers IC1b-IC1e. These in turn drive the MOC3040 optocoupler and the SC141D Triac.

### Construction

Assembly is straightforward but take care with the mains wiring to ensure personal safety. The printed circuit board used is the same for both circuits and is coded 84ht6 (66 x 54mm). This is mounted inside a metal diecast case (65 x 120 x 40mm), to which is fitted a Scotchcal front panel.

Begin by installing the parts on the PCB according to the appropriate layout diagram. Fit PC stakes to the external wiring points and make sure that you install the polarised components correctly. The Triac is mounted on the



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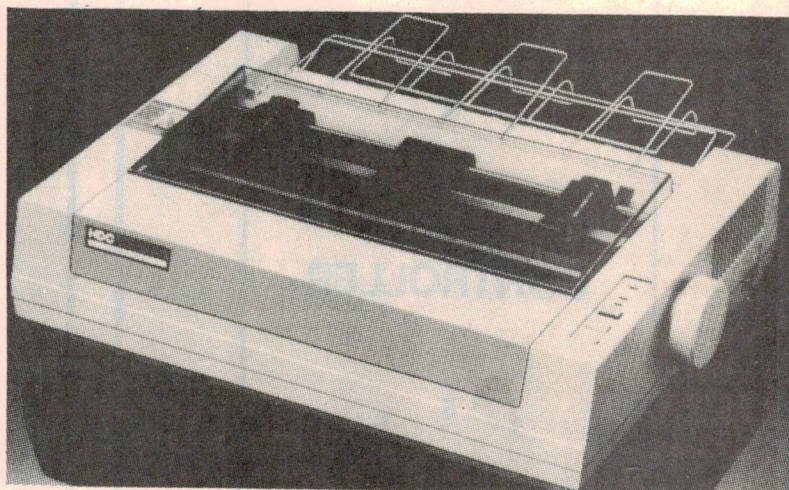
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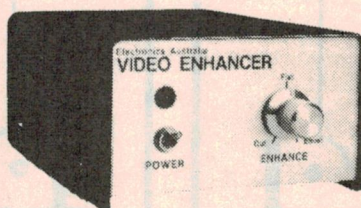
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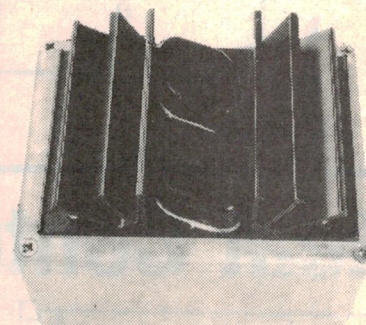
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# Heat Controllers

copper side of the PCB so that it can be bolted to the bottom of the case for heatsinking.

Fig. 3 shows the Triac mounting details. Bend the leads at right angles, close to the Triac body, then mount the device so that its bottom surface is exactly 6mm below the bottom surface of the PCB. Do not trim the Triac leads at this stage as some adjustment may be necessary later on.

Work can now begin on the diecast case. Spray the Scotchcal label with a clear lacquer, then carefully affix it to the front panel. The case can now be drilled to accept the various parts using the wiring diagram and the Scotchcal label as a guide. Deburr all holes before mounting the hardware and check that the Triac mounting hole is free of metal swarf.

The Triac must be isolated from the case using two mica washers and an insulating bush. Temporarily position the PCB on 6mm spacers inside the case and check that the Triac body lies flat against the bottom of the case. When

everything is correct, smear both sides of the mica washers with heatsink compound and bolt the Triac to the case using a machine screw and nut (Fig. 3).

It is a good idea to use a multimeter to check that the Triac is indeed isolated

from the case. If the meter registers a short circuit, remove the PCB assembly and locate the fault before proceeding.

The temperature sensor IC (Temperature Controller only) is mounted inside a small plastic case scrounged from an electronic buzzer. The buzzer mechanism and the plastic film are both removed and the IC affixed

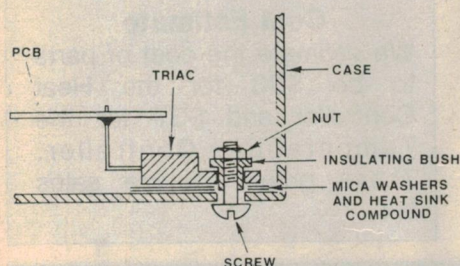
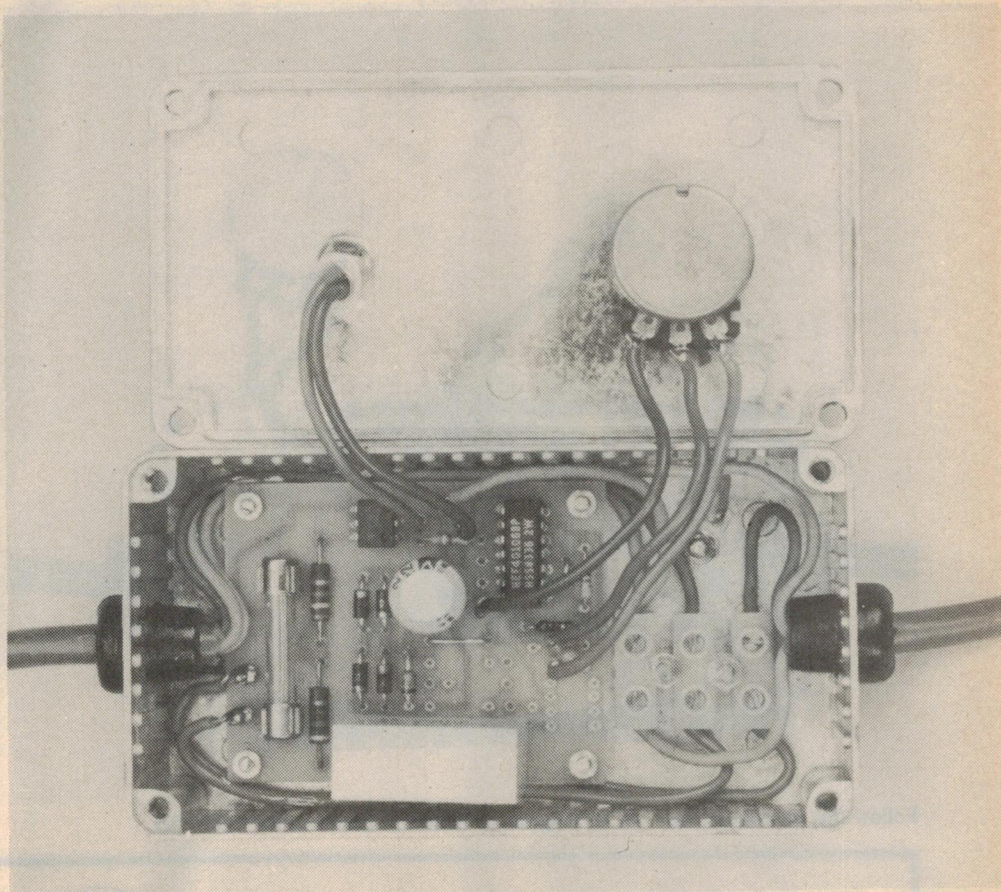
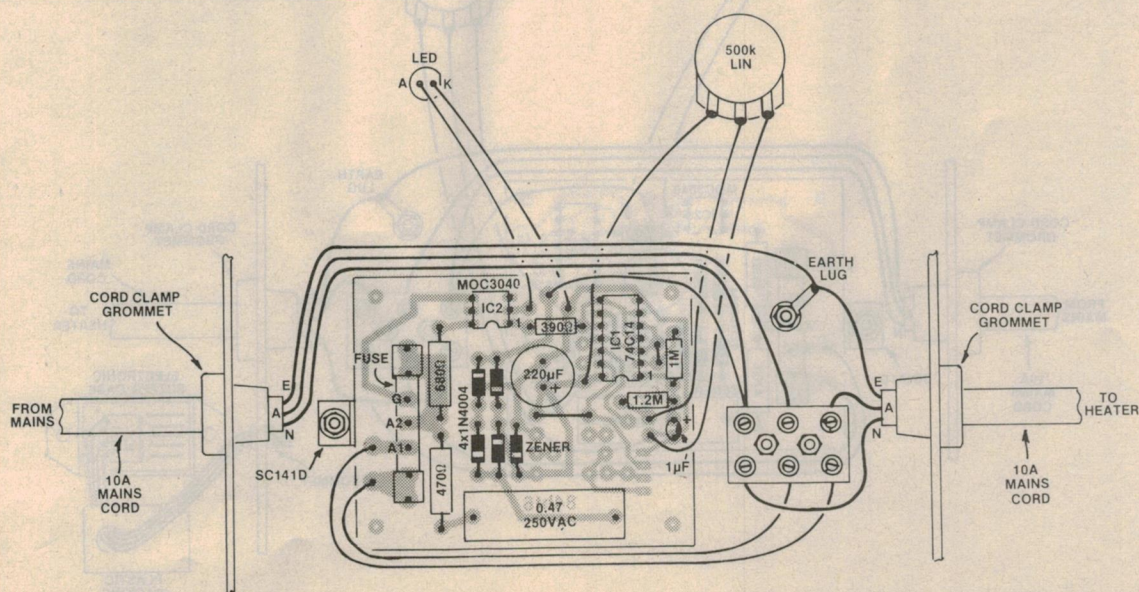


Fig. 3: Triac mounting details. The Triac must be fully insulated from the case.



Above is a view inside the Heat Controller while below is the wiring diagram.





# Heat Controllers

to the grill inside the case using epoxy resin. Mount the IC off centre so that pins 1-4 are not accessible from outside the case, as these pins can float at mains potential.

The remaining four pins are not

electrically connected and so are quite safe.

Note that all internal wiring except for the leads to the temperature sensor should be run using mains rated cable. The four leads to the temperature sensor

are run using rainbow cable and should all be sheathed in plastic tubing.

Take care with the mains wiring and make sure that you wire the plug and socket correctly. The brown lead goes to the active pin, the blue wire to the neutral pin, and the green/yellow wire to the earth pin. Lead length will depend upon the application but, as a guide, we used a 750mm length for the plug lead and a 250mm length for the socket lead.

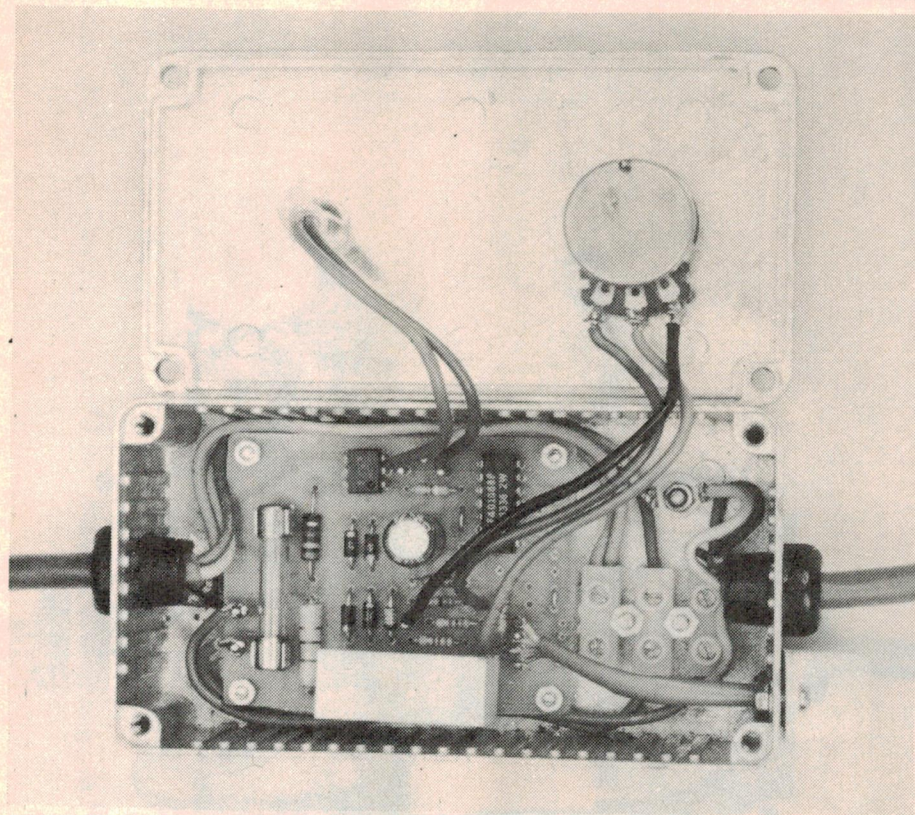
## Testing

Testing involves little more than plugging the unit into a mains outlet and applying power. In the case of the Heat Controller, the indicating LED should flash on and off with a duty cycle determined by the setting of the control knob. On the Temperature Controller, the LED should come on at a certain position as the control knob is advanced and extinguish when the control is turned back a few degrees from this position.

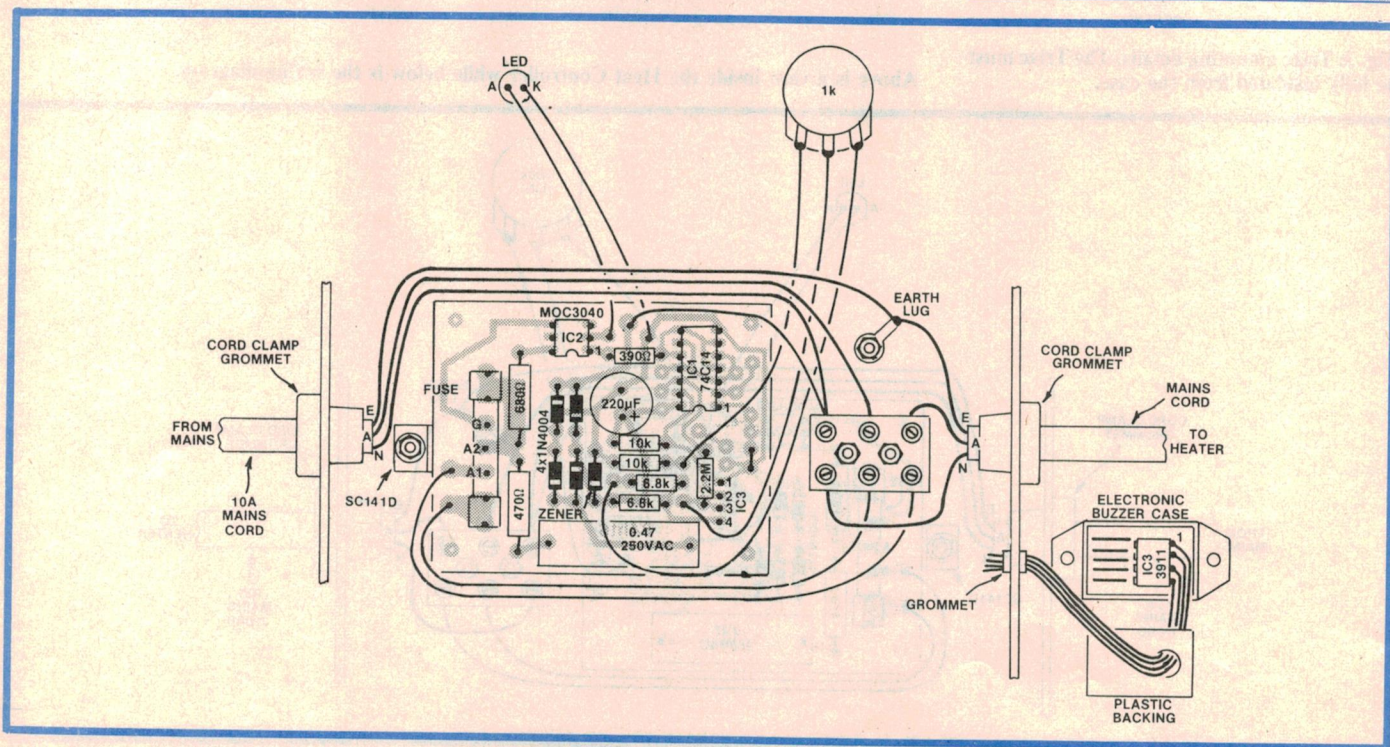
Just one final point. While these units have been rated for 1200W they can handle higher loads provided there is adequate heatsinking for the Triac. In practice, this means building the unit into a larger diecast case and increasing

## Cost Estimate

We estimate the cost of parts to be \$33 for the Heat Controller and \$37 for the Temperature Controller. These prices include sales tax.



Follow this photograph and wiring diagram to build the Temperature Controller.





the fuse rating. For loads of 2400W, use a 190 x 60 x 110mm diecast case and a 10A fuse. Make sure that all plugs, sockets and leads are correctly rated to handle the extra load. ③

### Parts List

- 1 metal diecast case, 65 x 120 x 40mm
- 1 PCB, code 84ht6, 66 x 54mm
- 1 3-way mains terminal block
- 1 10A mains line plug
- 1 10A mains line socket
- 2 cord clamp grommets
- 2 3AG PCB fuse clips
- 1 3AG 8A fuse
- 4 6mm PCB standoffs
- 1 earth lug
- 1 knob
- 4 rubber feet
- 1 TO-220 insulating bush
- 2 TO-220 mica insulating washers
- 1 1-metre length 3-core mains cord

### Semiconductors

- 1 74C14/40106 hex Schmitt trigger
- 1 MOC3040/3041 optically coupled Triac driver
- 1 SC141D 10A Triac or SC151D 15A Triac
- 4 1N4004 1A 400V diodes
- 1 15V 1W zener diode
- 1 5mm red LED plus bezel

### Capacitors & Resistors

- 1 220 $\mu$ F/25VW PC electrolytic capacitor
- 1 0.47 $\mu$ F/250VAC metallised dielectric capacitor
- 1 680 $\Omega$  1W resistor
- 1 470 $\Omega$  1W resistor
- 1 390 $\Omega$  1W resistor

### Extra parts for Temperature Controller

- 1 Scotchcal label, 65 x 120mm
- 1 LM 3911 temperature controller IC
- 1 electronic buzzer (see text)
- 1 2.2M $\Omega$  1/4W resistor
- 2 10k $\Omega$  1/4W resistors
- 2 6.8k $\Omega$  1/4W resistors
- 1 1k $\Omega$  linear potentiometer

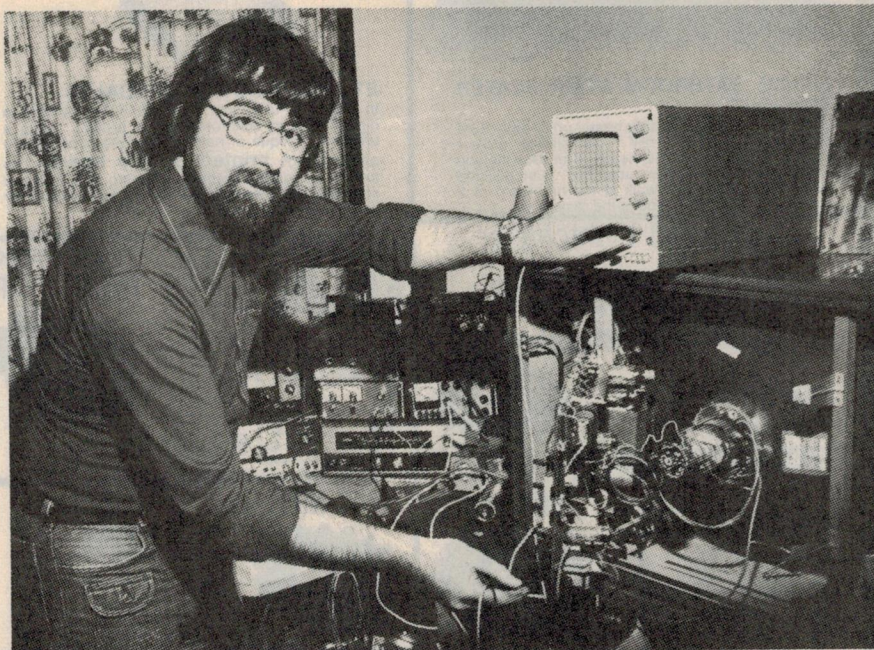
### Extra parts for Heat Controller

- 1 Scotchcal label, 65 x 120mm
- 1 1 $\mu$ F/25VW RBLL or tantalum electrolytic capacitor
- 1 1M $\Omega$  1/4W resistor
- 1 1.2M $\Omega$  1/4W resistor
- 1 500k $\Omega$  linear potentiometer

### Miscellaneous

PC stakes, screws, nuts, shakeproof washers, mains rated hook-up wire, solder, etc.

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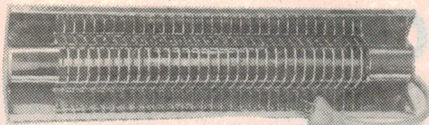
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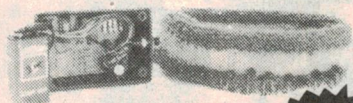
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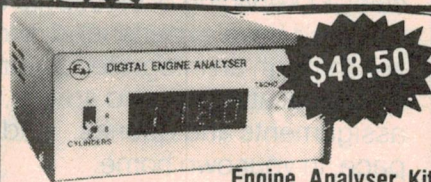
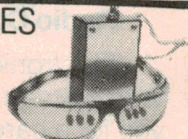


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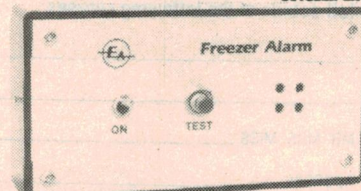


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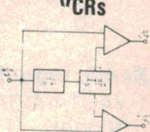
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300	235	29.6	82	28

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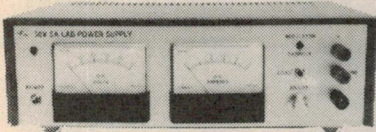
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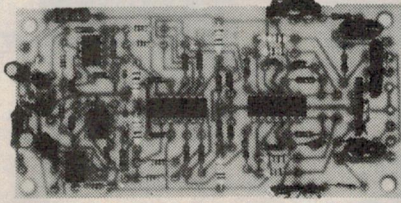


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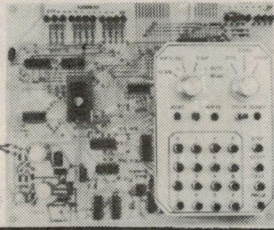
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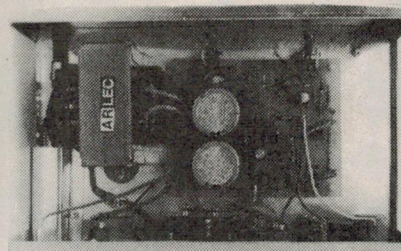
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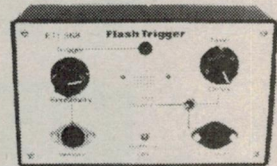
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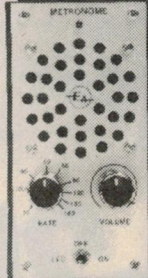
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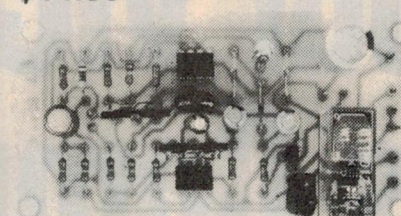
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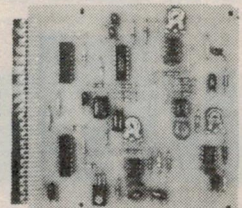
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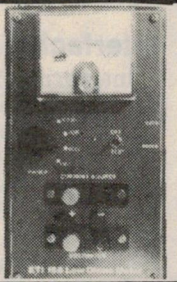
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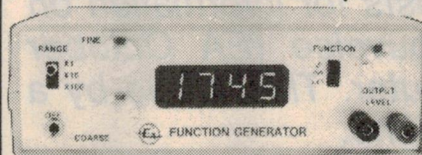
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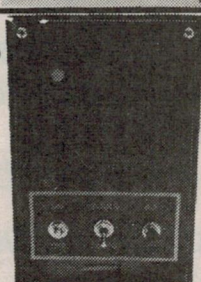


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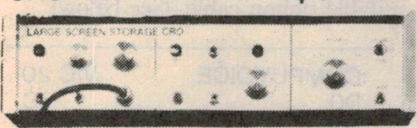
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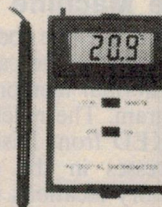


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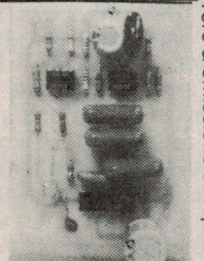
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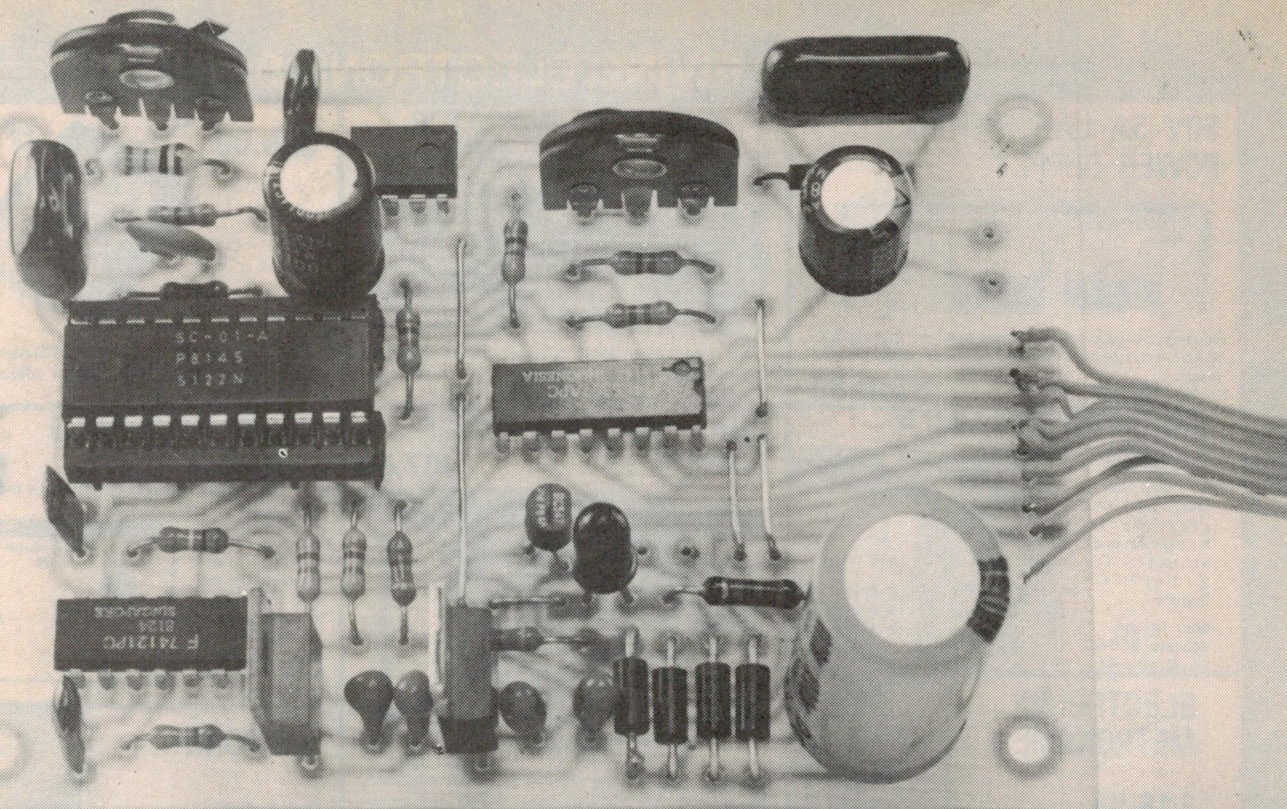
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# Make your VIC-20 talk with EA's Compuvoice

*We've received many requests for information on how to connect the Compuvoice (EA October 1982) to the VIC 20 computer. This article by a reader describes how it is done.*

by **GARRY BEAVAN\*** \*37 Lavarack St, Ryde, NSW, 2112.

As most VIC owners will realise the VIC 20 does not have a parallel Centronics port. The VIC does however have a general purpose parallel I/O port and by using this and a simple machine code routine, the Compuvoice can be used to its full capabilities.

The VIC 20's parallel port is referred to by Commodore as the "User Port". The User Port provides an 8-bit I/O port as well as a number of connections to the games port. Rather than take up space here, a full explanation of the User Port can be obtained in the VIC 20

Programmer's Manual.

## The Machine Code Program

The machine code program (see listing 1) resides in the cassette buffer, leaving the normal memory free for any Basic program. The machine code program is POKED from Basic into the particular addresses in the cassette buffer. The memory locations in the cassette buffer which do not contain the machine code program are used as a stack to store phonetic codes before they are sent to the Compuvoice.

## Interfacing

Interfacing between the VIC 20 and the Compuvoice is extremely simple. The Compuvoice is connected to the VIC via a 0.156 inch 24-pin (12/12) edge connector which fits the User Port on the VIC 20. This connector is available from Connect Electronics Pty Ltd, 22 Punch St, Artarmon 2064.

Table 1 shows the pin connections between the VIC and the Compuvoice. These connections can be made using a suitable ribbon cable. (See below)

COMPUVOICE	VIC 20
D0	C
D1	D
D2	E
D3	F
D4	H
D5	J
STB	M
A/R	L





Pin	Function	Pin	Function
1	GND	A	GND
2	+5V	B	CB1
3	RESET	C	PBO
4	Joystick O	D	PB1
5	Joystick 1	E	PB2
6	Joystick 2	F	PB3
7	Light Pen	H	PB4
8	Cassette switch	J	PB5
9	Serial In	K	PB6
10	+9V	L	PB7
11	GND	M	CB2
12	GND	N	GND

```

033C LDA $3F
033E STA $9110
0341 LDA $7F
0343 STA $9112
0346 LDA $A2
0348 STA $911C
034B LDX $00
034D LDA $0336,X
0350 CMP $FF
0352 BNE $0355
0354 RTS
0355 PHA
0356 LDA $9110
0359 AND $80
035B BNE $0356
035D PLA
035E STA $9110
0361 INX
0362 JMP $034D

```

## The Basic Program

The Basic program (see listing below) is used to install the machine code program, "compile" the phonetic words, speak these words and display their phonetic and numeric codes.

Lines 10, 20, 30, 900, 910, 920, are the program lines involved with the machine code program. These six lines may be included in other programs using the Compuvoice. The machine code program is called with SYS 828.

Memory locations 870-1018 are the locations used to "stack" the phonetic codes. The first phonetic code is placed in location 870, the next code in location 871, the next in 872 etc. The end of the word is signified by placing a value of 255 immediately after the last phonetic code to tell the machine code program to return to Basic.

The program shown in listings performs all of the above functions as well as a few extras.

After the program is RUN the prompt

"PHONEME" appears on the screen and at this point, the user may give the computer a phoneme symbol followed by a carriage return. When the phonemes have been entered, the user may hear the message by typing "SPEAK". Typing in "DISPLAY" will cause the computer to display the message in phonetic and numerical code, while "START" will clear the last message and prepare the computer for a new message.

That's all there is to it. VIC 20 owners can have a talking computer!

```

10 AD=828
20 READ D:IF D=-999 THEN 100
30 POKE AD,D:AD=AD+1:GOTO 20
100 DIM A(250),A$(250)
110 PRINT"☐":RESTORE:AD=870
120 FOR B=1 TO 250
130 INPUT"PHONEME";A$
131 IF A$="SPEAK" THEN 200
132 IF A$="DISPLAY" THEN 300
133 IF A$="START" THEN GOTO 110
139 FOR S=1 TO 55:READ T:NEXT
140 FOR X=0 TO 63:READ D$:IF D$=A$ THEN A$(B)=A$:A(B)=X:FL=1
150 NEXT:IF FL=0 THEN PRINT "HAVEN'T GOT THAT":B=B-1
160 FL=0:RESTORE:NEXT B
200 FOR Z=1 TO B-1:POKE AD,A(Z)
210 AD=AD+1:NEXT:POKE AD,255:AD=870:SYS 828:GOTO 130
300 FOR Z=1 TO B-1:PRINT A$(Z);A(Z):FOR D=1 TO 300:NEXT: NEXT: GOTO 130
900 DATA 169,63,141,16,145,169,127,141,18,145,169,162,141,28,145,162,0,189
910 DATA 102,3,201,255,208,1,96,72,173,16,145,41,128,208,249,104,141
920 DATA 16,145,232,76,77,3,2,32,247,171,22,1,245,247,215,22,171,1,26,-999
1000 DATA EH3,EH2,EH1,PA0,DT,A2,A1,ZH,AH2,I3,I2,I1,M,N,B,V,CH,SH,Z,AW1
1005 DATA NG,AH1
1010 DATA OOL,OO,L,K,J,H,G,F,D,S,A,AY,Y1,UH3,AH,P,O,I,U,Y,T,R,E W,AE,AE1
1020 DATA AW2,UH2,UH1,UH,O2,O1,IU,U1,THV,TH,ER,EH,E1,AW,PA1,STOP

```



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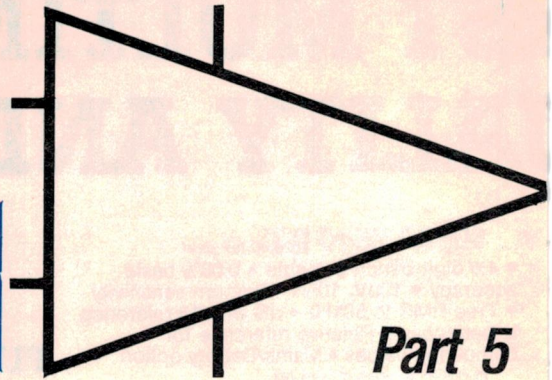
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# OP AMPS Explained



## Part 5

*There is a crying need for differential amplification in our homes, industry, rock concerts, research science and control systems to remove unwanted interfering voltages. The why and how is our entertainment this month.*

It all started (sounds like a fairy tale, doesn't it) some time ago. A number of seemingly unrelated happenings slowly developed to create a need for differential amplifiers. Firstly, the beginnings of the hi-fi movement saw

microphones and record player pick-ups having excellent performance characteristics appear in the market place. A side effect of their improved performance was much smaller output voltage. The very earliest crystal pick-ups

put out a massive 2.5 volt signal from 78rpm records. By contrast, later ceramic pick-ups measure their output in hundreds of millivolts, while the now standard magnetic cartridges measure their output in millivolts. To own sensitive high gain preamplifiers capable of handling these tiny signals became everyone's aim and talking point.

Simultaneously our homes spawned a variety of electrical equipment which quite successfully generated unwanted electromagnetic interference, and proceeded to radiate straight into the input stages of our sensitive preamplifiers.

In the industrial scene as operational amplifiers began to establish themselves, electro-mechanical transducers were being used in greater numbers. Many, like resistive strain gauges, spent their lives giving forth microvolt or millivolt signals. Naturally, sensitive high gain preamplifiers were used there too, and just as naturally these picked up a veritable barrage of industrial electromagnetic radiated noise.

To add to the confusion, some industrial processes were so devised that the small transducer voltage to be amplified was not a "voltage to ground" as we fondly imagine. Rather it may well be that the millivolt signal we want to amplify is "up in the air" by a few volts. Fig. 1 shows what we would like to have, but Fig. 2 shows a real simplified circuit typical of the factory situation. The signal we want is found between A and B, and is only a few millivolts but due to the way the industrial machine is built it may well be that many volts exist between A and ground, and between B and ground.

These unwanted volts to ground which A and B have in common are called the "common mode signal". The wanted millivolt difference between A and B is called the "differential mode signal".

If the differential mode signal is simply a DC voltage and we only wanted to read it on a voltmeter that would be easy, as a

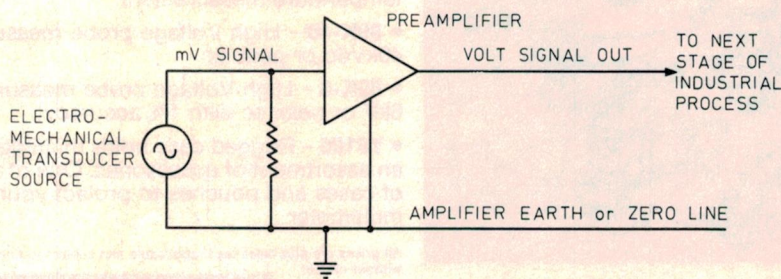


Fig. 1: circuit design is made much easier if one side of the signal source is grounded. In practice, it's usually not so easy.

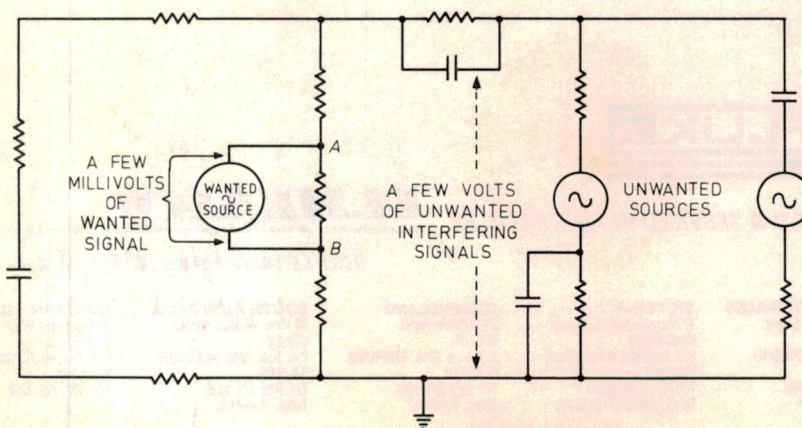


Fig. 2: the true situation for a particular industrial millivolt source A-B. In addition, there is unavoidable interference generated by outside sources — that's the way it is in real life.



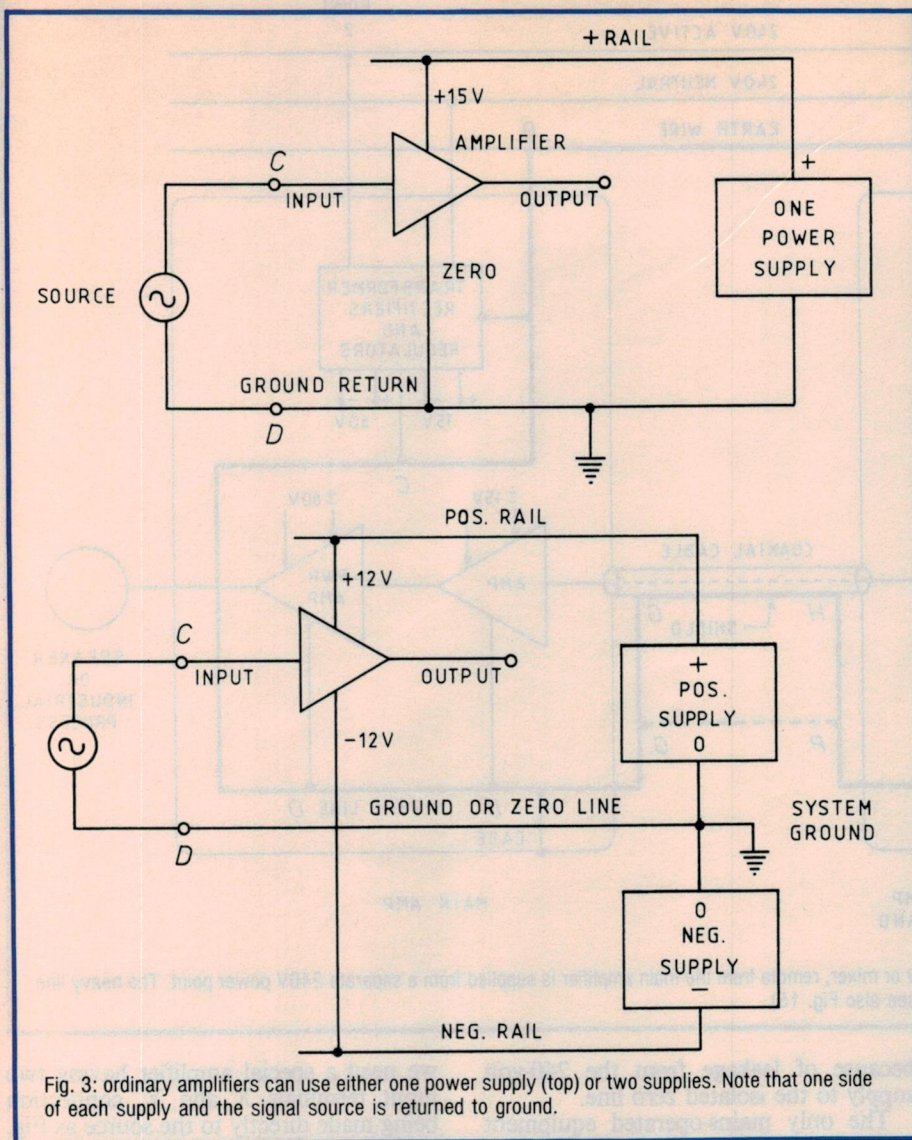


Fig. 3: ordinary amplifiers can use either one power supply (top) or two supplies. Note that one side of each supply and the signal source is returned to ground.

voltmeter simply connected between A and B would do the trick. But if that source is some kind of transducer, say an electro-mechanical vibration sensor, then its output would be a rapidly changing voltage. Then we would need some form of sensitive wideband "floating" amplifier for our measurement system.

Ordinary amplifiers have their "low-side" connected to ground, as Fig. 3 illustrates, whether they work from one power supply rail or two. To jump in first before you have time to object, why cannot that earth point on the power supply be disconnected from ground and then the source A-B in Fig. 2 simply connected to C-D in Fig. 3?

Well it's not as easy as that.

The answer to your question is that such an approach has been tried by some people but usually with terrible results, for a number of reasons.

Firstly, if that amplifier is a feedback system like an operational amplifier, it

may well be unstable if run from unearthed power rails. Secondly, if the power supply is a voltage regulator, that probably will be unstable and oscillate if run ungrounded. And if we were to survive those two hurdles, we would probably find mountains of 50Hz ripple (mains hum) on the supply rails and the output because of stray capacitive coupling between primary and secondary windings of the power transformer. Worse still — it's dangerous! People have been killed that way.

### A new problem

Just when you thought it was safe to jump back into circuit design, another problem appeared beneath the waves. And a nasty one too! It became a popular idea for pop groups, rock concerts, stage performances and our lounge rooms to use two or more pieces of audio equipment in the signal path, at two different locations, each from separate

240VAC power points.

But people were disquieted by an insidious rise in hum level. The offending hum level was, of course, caused by 50Hz intruding into the low level signals from microphone, pickup or tape deck due to "earth loops" as illustrated in Fig. 4.

### Earth loops

Two different phenomena contribute to "earth loop hum". First all 50Hz mains circuits do radiate some electromagnetic signal in the same manner as does an RF transmitting antenna. Admittedly, much less than the RF case but still it occurs. Any closed circuit in the vicinity will have a small 50Hz current induced in it. The loop labelled A B C D G H J K A in Fig. 4 acts as such a "receiver" and if careful measurements were made we would find a 50Hz current circulating in it.

In tests your author has carried out in an electronics workshop, 50Hz current induced in a circular loop of cable laid on the floor (connected to nothing) was measured in milliamps. The current induced is proportional to the loop area and the strength of the 50Hz field present. This induced loop current flows in the shield of the shielded cable HG in Fig. 4 so causing a small voltage drop between H-G. Even the addition of a cable PQ does not help much unless it is of enormous cross-section like the heavy copper bar used for this purpose in some special installations. Other equipment can also radiate 50Hz signals into such earth loops, the worst offenders being TV receivers or close TV transmitters (50Hz frame signal) or silicon controlled-rectifiers (50Hz buzz).

A second cause of 50Hz hum in Fig. 4 can be leakage from power equipment and mains bypass capacitor current (including cable capacitance current). Flowing in the earth wire from B to the switchboard, this current causes a voltage drop in earthwire B-A, effectively being a small 50Hz signal between J and D and hence appearing in the output as hum. It is a fact when different equipment is plugged into different power points in a building their earthed metal cases (and hence their internal zero lines) are not quite at the same potential. True, the differences are only millivolts, but those millivolts might be substantial compared to our wanted signal when added to it.

### Danger

One thing we should never do is to break the earth wire to any of the equipment in order to stop this earth loop hum. This is an extremely dangerous practice and can (and has) led



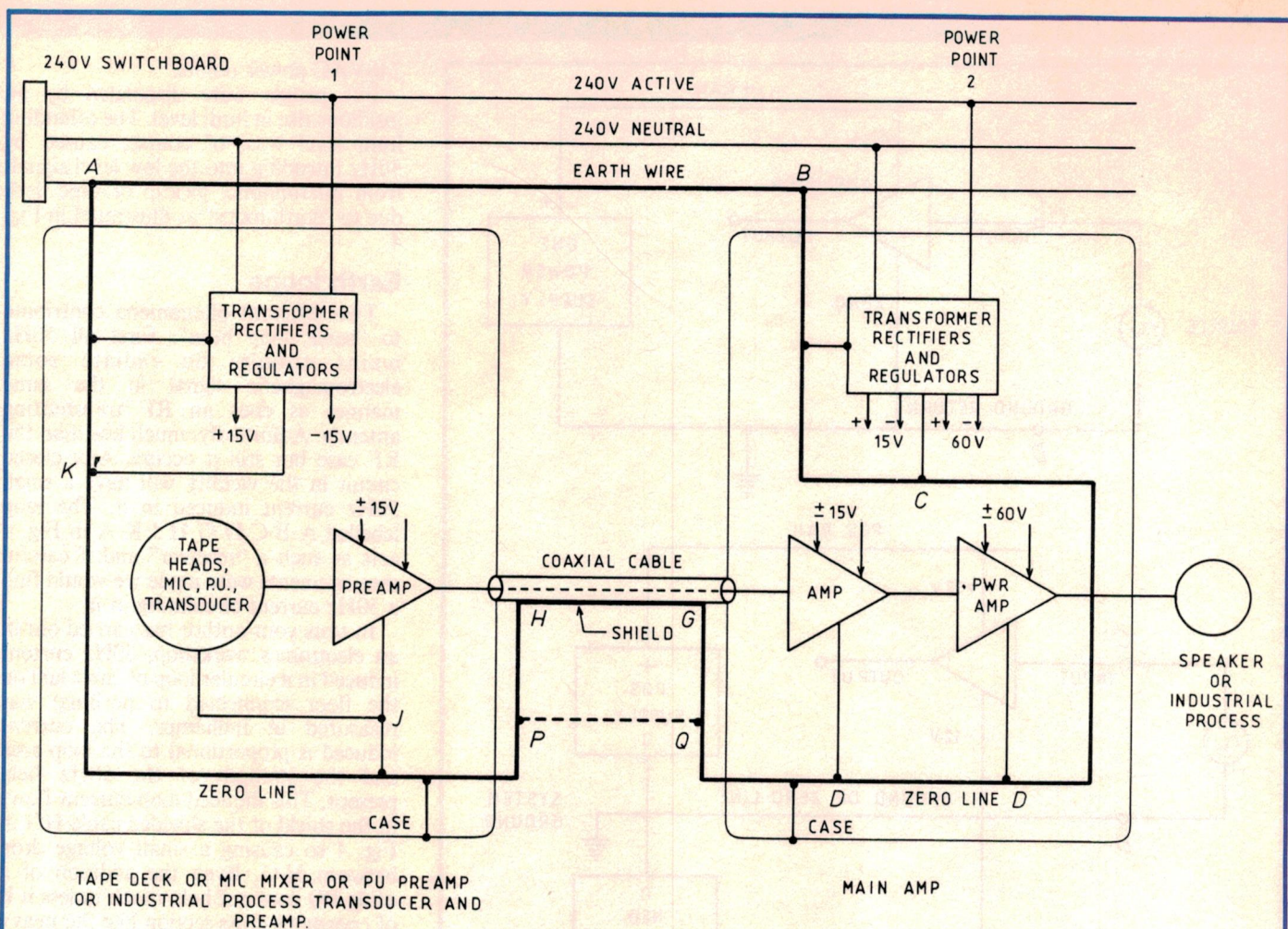


Fig. 4: an earth loop can be created when a preamplifier or mixer, remote from the main amplifier is supplied from a separate 240V power point. The heavy line shows the enclosed loop which causes interference (see also Fig. 15).

## OP AMPS Explained

to the electrocution of users of microphones, guitars and other gear

because of leakage from the 240-volt supply to the isolated zero line.

The only mains-operated equipment which can be safely operated without an earth lead is that which is labelled as "double-insulated".

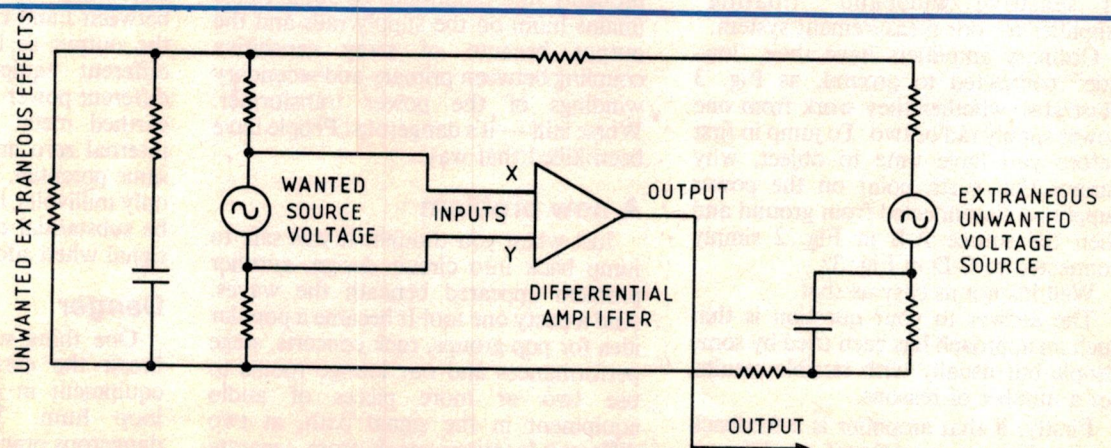
### The right way

To satisfy the need to discriminate between wanted and unwanted signals,

we need a special amplifier having two input terminals X and Y, connection being made directly to the source as Fig. 5. To be successful, this amplifier should only respond to voltages between X and Y, while completely ignoring any voltages between X and ground or between Y and ground. In symbols we say:

$$V(\text{out}) = (\text{gain})[V(X) - V(Y)]$$

Fig. 5: the correct way to amplify the wanted differential mode signal while ignoring unwanted common mode signals. The differential amplifier "sees" only the wanted voltage X-Y.





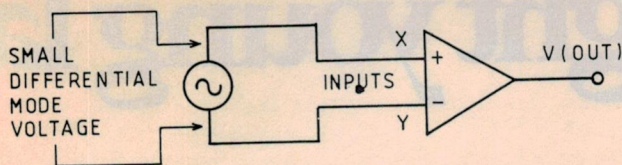


Fig. 6a: basic differential mode gain test circuit.

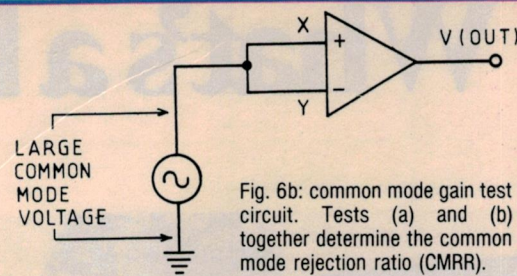


Fig. 6b: common mode gain test circuit. Tests (a) and (b) together determine the common mode rejection ratio (CMRR).

That's what we would like. But can our wish be achieved? The answer is: "Almost — but not quite". Naturally the next question is "how close can we get to the ideal?" In answer we make a definition, thus: If  $[V(X) - V(Y)]$  is called the "Differential Mode Signal" and  $[V(X) - \text{ground}] \approx [V(Y) - \text{ground}]$  is called the "Common Mode Signal" we make a simple measurement upon our special amplifier as in Fig. 6. First measure the differential mode gain, expected to be a high number, then measure the common mode gain which we hope will be a small number. Then define the common mode rejection ratio, or CMRR thus:

$$\text{CMRR} = \frac{\text{Differential Mode Gain}}{\text{Common Mode Gain}}$$

The ideal would be that the differential gain is as high as we want and the common mode gain is zero, making the CMRR infinite. Naturally, we don't ever achieve that, but practical amplifiers do achieve CMRR values of 10,000 to 1,000,000. With such high numbers to talk about, it is convenient to use the logarithmic decibel unit thus:

$$\text{CMRR} = 20 \log_{10} \left( \frac{\text{Differential Gain}}{\text{Common Mode Gain}} \right)$$

Actual measurements made on a particular amplifier are shown in Table 1 for a sinewave test signal at a low frequency 10Hz. Don't be surprised if your pride and joy differential amplifier shows a high measured CMRR at low frequencies but falls off at higher frequencies. Many amplifiers do just this. Fig. 7 shows the complete result for the amplifier mentioned in Table 1 for the frequency range DC to 100kHz.

To see just why CMRR drops off at higher frequencies let us look into the amplifier's innermost secrets.

## Differential design

The long-tail pair (with which readers are now familiar; see last month) is the favourite. Notice that just making the first stage differential is sufficient as in Fig. 8. We can trust the long tail pair Q1A and B to perform the differencing operation because signals V(X) at input 3 are amplified with an even number of

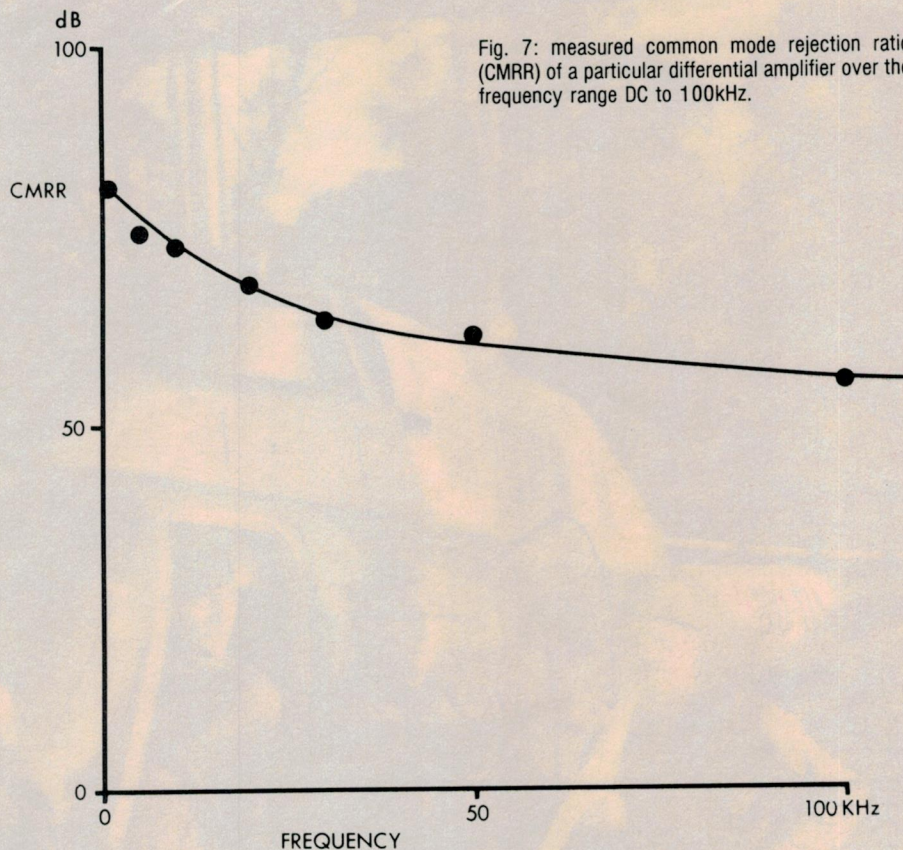


Fig. 7: measured common mode rejection ratio (CMRR) of a particular differential amplifier over the frequency range DC to 100kHz.

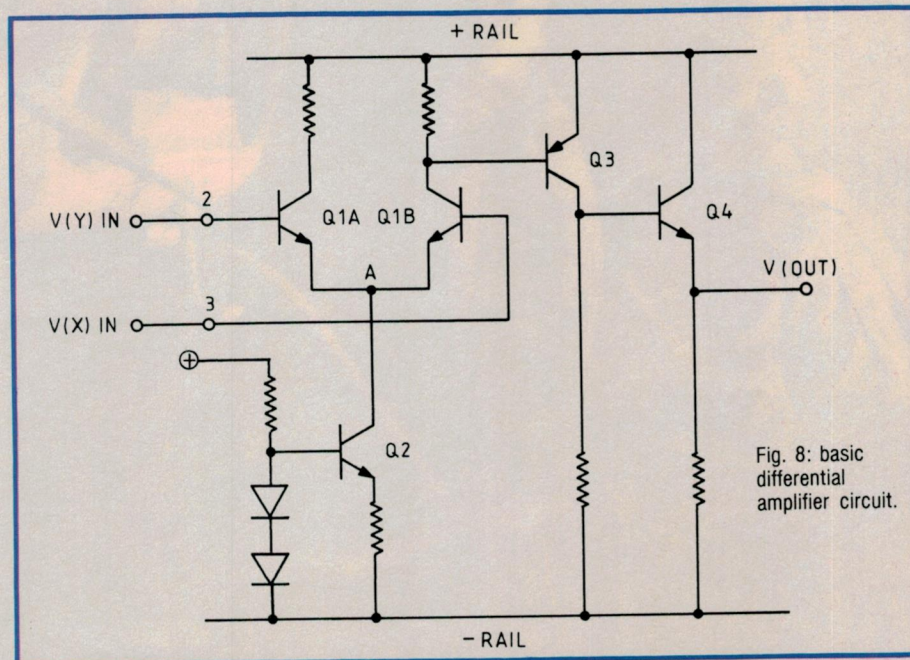
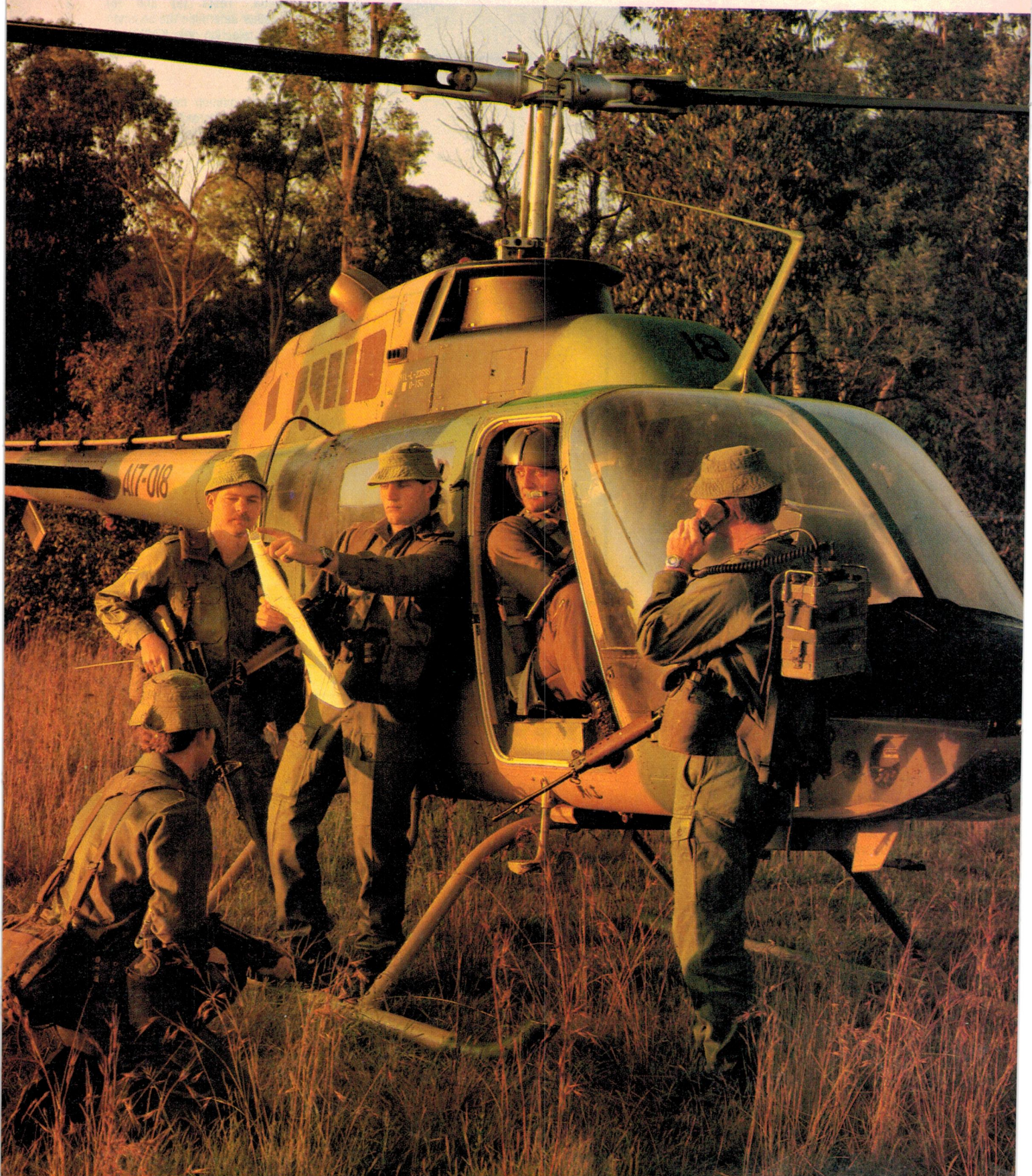


Fig. 8: basic differential amplifier circuit.



# What's a bright young lad





# Like you doing in the Army?

The simple answer of course, is that he's busy taking on all the responsibilities that come to young men bright and dedicated enough to succeed as Army Officers.

After that it gets a little tricky. Largely because once a young man completes his initial 44 weeks training at Officer Cadet School, Portsea, and graduates with a commission, his career can take a multitude of directions.

He might for example choose to enter an Infantry Battalion and become a Platoon Commander in charge of 30 men. In which case he'll obviously learn and be involved in different things to a man who flies a helicopter and commands a smaller crew. The same applies in areas like Armour, Artillery, Signals, Survey, Transport and Intelligence to name just a few.

There is, however, common ground on which every Officer stands. Irrespective of his rank or career choice.

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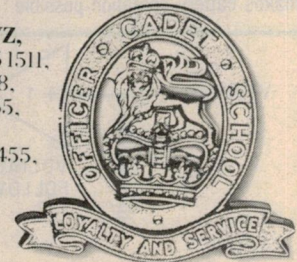
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# OP AMPS Explained

phase changes to the output while signals  $V(Y)$  at input 2 are amplified with an odd number of phase changes.

So  $V(\text{out}) = (+1)(\text{gain})[V(X)] + (-1)(\text{gain})[V(Y)]$

Then provided the gains of Q1A and Q1B are identical:

$$V(\text{out}) = [V(X) - V(Y)](\text{gain})$$

Somewhat separate from the above differencing operation is the achievement of good common mode rejection. Equality of gains of Q1A and Q1B looks at first glance to be sufficient for high CMRR, as equal input signals ought to produce zero output.

That perfect state of affairs is almost achieved, but not quite, for a few reasons:

1. The gains of Q1A and Q1B to the output are not precisely equal as no two transistors are identical.

2. The pathway from input 3 to output involves Q1B as a common emitter amplifier with signal into base. (We recall that A is a virtual earth point). But the pathway from input 2 to output looks a bit like Q1A as an emitter follower driving Q1B as a common base stage with signal into emitter.

3. Application of a reasonably large common-mode voltage to both inputs 2 and 3 lifts both transistors Q1A and B and the virtual earth A up to a different voltage level, slightly changing the "constant" tail current through Q2. This change in current does produce some output at Q1B's collector when ideally it should not. Thus we see a condition for high CMRR: that the tail current through Q2 be constant.

This means that Q2 should represent an almost infinite resistance.

## Differential op amps

Many of the integrated amplifiers available in the marketplace are based on the simplification shown in Fig. 8 and are capable of excellent differential results. The standard simple differential operational amplifier Fig. 9 shows the general idea, while Fig. 10 uses the LM108AH as an example with a gain of 100. Here we make good use of the 108's properties of balance, low input current and low supply rail current. Your author (bless him) uses Fig. 10 operating from a pair of 9V batteries type 216 changed yearly. Sometimes he forgets to switch off the battery supply but it makes little difference as measured battery current is 480 microamps.

Though Figs. 9 and 10 work very nicely they do have a couple of little drawbacks. Firstly the input impedance is low, as it is with all simple operational amplifiers. Secondly, the impedances of the two inputs are different, as the resistors and virtual earth are unbalanced. Notice that the virtual earth effect is now different; that theory predicts a very low voltage and an apparent low impedance between pins 2 and 3 of the integrated amplifier, rather than to ground. Because there is no feedback to pin 3 (and the impedance into the integrated amplifier itself is fairly high) we must view  $R_{iB}$  and  $R_{fB}$  as a simple voltage divider in Figs. 9 and 10. However,  $R_{iA}$  and  $R_{fA}$  are not a voltage divider because  $R_{fA}$  is a feedback path. Feedback forces the voltage at pin 2 to be about the same as the voltage at pin 3, the latter being set by the voltage divider effect thus:

$$V(\text{pin } 3) = V_{in} + [R_{fB}/(R_{iB} + R_{fB})]$$

The negative feedback forces the system to make  $V(\text{pin } 2)$  very nearly equal to  $V(\text{pin } 3)$ .

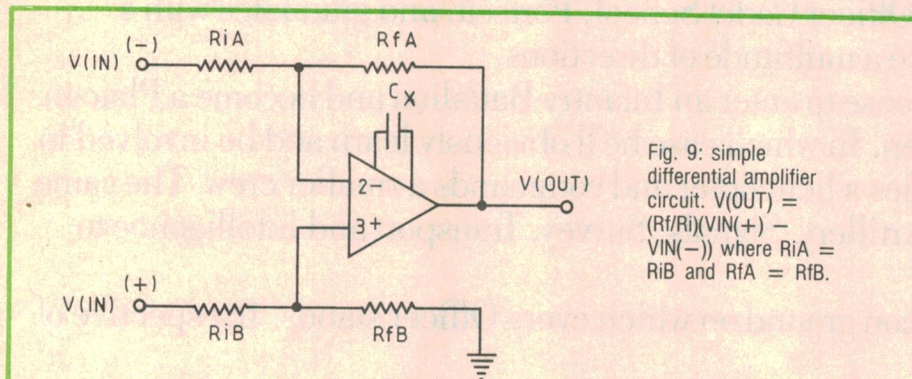


Fig. 9: simple differential amplifier circuit.  $V(\text{OUT}) = (R_{fA}/R_{iA})V(\text{IN}(+)) - V(\text{IN}(-))$  where  $R_{iA} = R_{iB}$  and  $R_{fA} = R_{fB}$ .

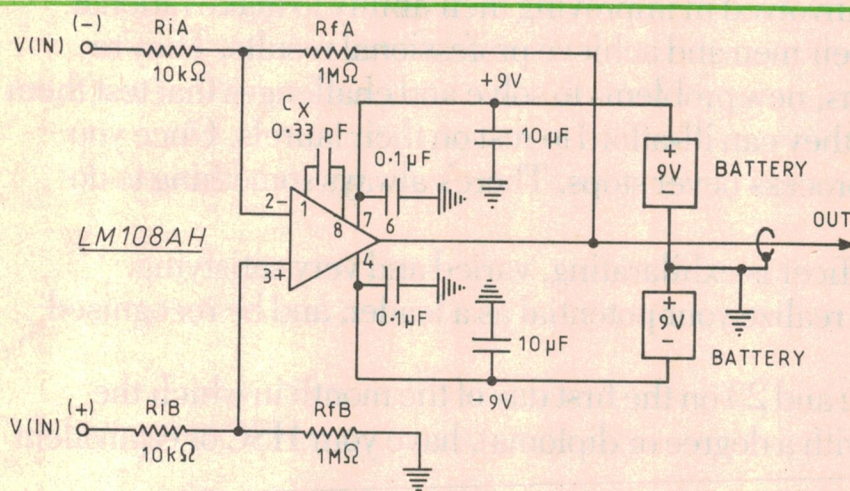


Fig. 10: simple differential op amp with gain = 100. The low supply current required by the LM108 IC makes battery operation possible.

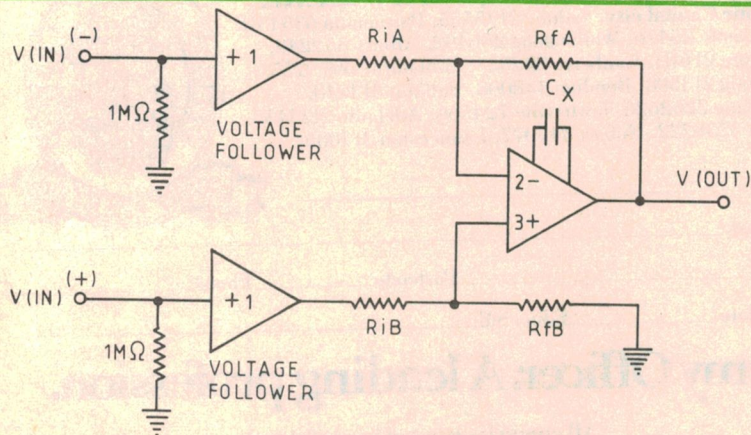


Fig. 11: basic instrumentation amplifier. The voltage followers have a gain of +1 but provide high input resistance.



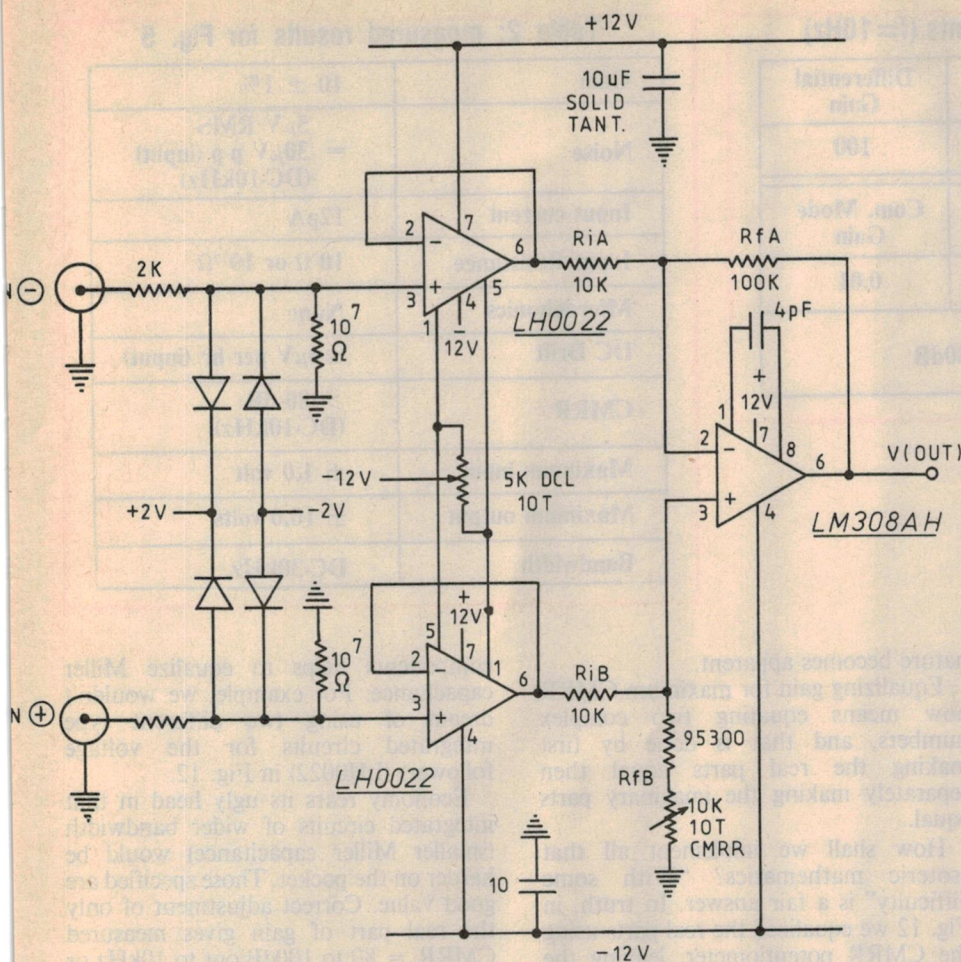


Fig. 12: high stability, high input impedance instrumentation amplifier.  $Z(\text{in}) = 10\text{M}\Omega$ ,  $Z(\text{out}) = 1\Omega$ , Gain = 10, CMRR > 80dB, bandwidth DC - 30kHz. Note that all supply pins (7 and 4) should be bypassed using a  $0.1\mu\text{F}$  ceramic capacitor.

### Instrumentation amplifier

High and equal input impedances would be nice. This can be achieved by an extension of the foregoing circuits, adding two voltage followers at the front. The complete circuit, Fig. 11, is known as an instrumentation amplifier because it finds application in professional equipment and electronic measuring instruments. You can implement Fig. 11 using LM310H for the voltage followers

and LM308AH for the gain stage following. Making  $R_{iA} = R_{iB}$  and then  $R_{fA} = R_{fB}$  the output voltage will be:

$$V(\text{out}) = R_{fA} [(V_{in+}) - (V_{in-})]$$

The input impedance will be 1 megohm and the output impedance about 1 ohm.

For higher still performance you could build Fig. 12, a professional quality instrumentation amplifier DC coupled, having a high value CMRR, and

bandwidth DC to 30kHz. The gain is set by  $(R_f/R_i)$  and a value of 10 was chosen in this case; higher or lower values could be used.  $R_i$  ought not be less than 1000 ohms as  $R_i$  is a load on the preceding LH0022.  $R_f$  may be anything up to 1 megohm. Use  $R_{iA} = R_{iB}$  and also  $R_{fA} = R_{fB}$ .  $C_x$  should be made equal to  $33(R_f/R_i)$  picofarads. The LH0022 integrated amplifiers are FET input, and are connected as unity gain voltage followers. Others such as the AD545 would also be suitable. They provide gain = +1 with high input impedance. The 10MΩ resistors give the return path to ground. The 5kΩ 10-turn potentiometer marked DCL is for precision DC level adjustment. It is set for zero output when both inputs are grounded as in Fig. 13(c).

The 10kΩ 10-turn potentiometer marked CMRR is for adjustment of  $R_{fB}$  to ensure that the gains from the two inputs to the output are identical, for best possible CMRR. It is set for minimum output signal when a low frequency sine wave signal of about 1V is applied to both inputs simultaneously as in Fig. 13(d). With careful symmetrical construction a CMRR of 80dB to 110dB at 50Hz can be realised. The higher this value the more difficult its measurement and adjustment.

Although the circuit does have very good symmetry and is not very sensitive to changes in its rail voltages, for lowest possible DC drift use well regulated plus and minus 12 volt supplies. Bypassing of both rails is essential, using 10μF solid tantalum capacitors and 0.1μF ceramic capacitors to bypass every pin 7 and every pin 4 to the zero line. The ideal construction method is a double-sided printed board with the circuit on front and power rails and earth plane on back (top). Table 2 shows the measured results on the circuit of Fig. 12.

### High frequencies

The amplifiers discussed have no trouble working over the audio

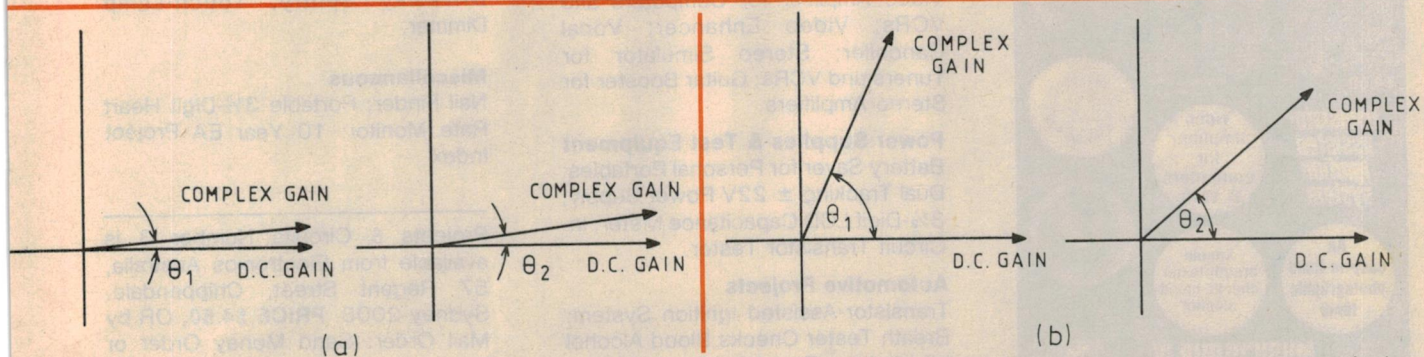


Fig. 13a, b: the left hand axes of Fig. 13a represent complex gain from the non-inverting (+) input to the output, while the right hand axes refer to the gain from the inverting (-) input to the output. For best CMRR, both complex

numbers should be equal. Unequal delay angles are not serious for low frequencies at (a) but large discrepancy at (b) means unequal complex gain and hence degraded CMRR at high frequencies.



**Table 1: Typical CMRR measurements (f=10Hz)**

Differential Mode Fig. 6a	$V_x - V_y$	$V_{OUT}$	Differential Gain
	10mV	1.0V	100
Common Mode Fig. 6b	$V_x = V_y$	$V_{OUT}$	Com. Mode Gain
	2.0V	20mV	0.01

$$CMRR = \frac{100}{0.01} = 10,000 = 80dB$$

**Table 2: measured results for Fig. 5**

Gain	$10 \pm 1\%$
Noise	$5\mu V$ RMS = $30\mu V$ p-p (input) (DC-10kHz)
Input current	12pA
Input Resistance	$10^7\Omega$ or $10^{12}\Omega$
Microphonics	None
DC Drift	$\leq 6\mu V$ per hr (input)
CMRR	$> 80$ dB (DC-10kHz)
Maximum input	$\pm 1.0$ volt
Maximum output	$\pm 10.0$ volts
Bandwidth	DC-30kHz

# OP AMPS Explained

frequency range, but maintaining a high CMRR is more difficult at higher frequencies. The symmetry of circuit and construction, so conducive to high common-mode rejection, is easy for low frequencies at which stray capacitance has no effect. But when CMRR is measured at higher frequencies, the reactive nature of all circuit components becomes evident. As well as equalizing the gain from each input to output, we must also equalize the time delay (phase or angle delay) in each path.

That's not so easy!

You can say that gain of any amplifier is always a complex number (we all remember complex numbers — don't we?). The real part of this complex number represents the DC gain and the imaginary part represents the phase delay as in Fig. 13(a) and (b). At very low frequencies the delay is so small that the gain seems to be simply a real number but at higher frequencies the complex

nature becomes apparent.

Equalizing gain for maximum CMRR now means equating two complex numbers, and that is done by first making the real parts equal then separately making the imaginary parts equal.

How shall we implement all that esoteric mathematics? "With some difficulty" is a fair answer. In truth, in Fig. 12 we equalized the real parts using the CMRR potentiometer, leaving the imaginary parts untouched at whatever value stray circuit capacitance dictates. To equate phase delays usually means adding a trimming capacitor somewhere, a delicate task indeed! This is actually done in some professional amplifiers.

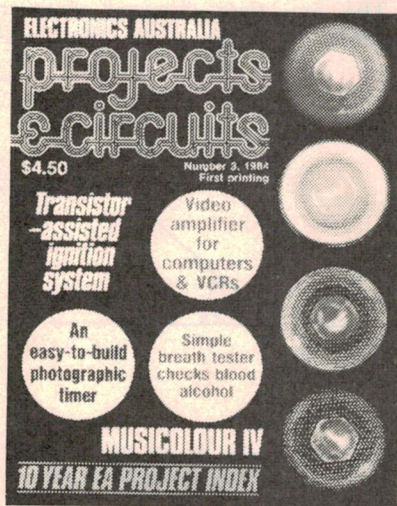
An alternative philosophy, adopted in Fig. 12, is to design for best symmetry and lowest economical phase delay. Symmetry of construction and circuit tends to equalize stray capacitance, and using identical semiconductor

components helps to equalize Miller capacitance. For example, we wouldn't dream of using two different type integrated circuits for the voltage followers (LH0022) in Fig. 12.

Economy rears its ugly head in that integrated circuits of wider bandwidth (smaller Miller capacitance) would be harder on the pocket. Those specified are good value. Correct adjustment of only the real part of gain gives measured CMRR = 80 to 100dB out to 10kHz or more. Adjustments to Fig. 12 are easy as per Fig. 13(c) and (d).

## Applications

Now that we feel quite at home with differential amplifiers, how shall we put their properties to good use? Easily! We just use two coaxial cables, one for each input and connect our pride and joy amplifier directly to the source, as in Fig. 14. The two coaxial cables should be run close together or lightly twisted, simply



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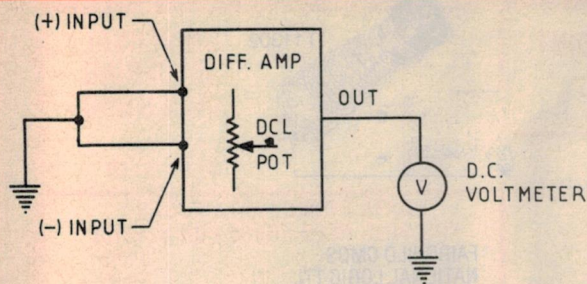


Fig. 13c: the DC level (DCL) potentiometer is adjusted to give zero DC output with both inputs to the differential amplifier shorted and grounded.

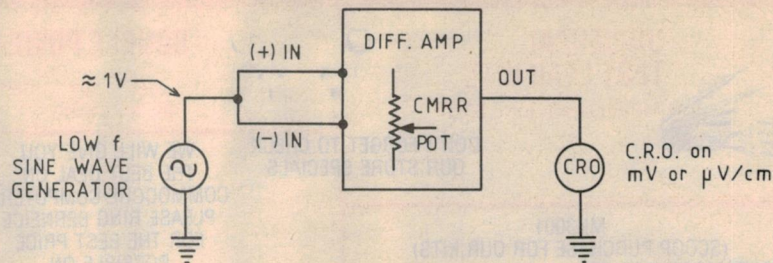


Fig. 13d: the CMRR potentiometer is adjusted for minimum output with a 1V low-frequency signal applied to both inputs.

so that any interference picked up will tend to cancel by being the same in each.

Alternatively one two-core shielded cable can be used as in Fig. 15. When using the latter, choose stiff cable with tightly woven heavy copper shielding braid for best effect.

Notice that in Fig. 15 each part of the installation is properly earthed, but no earth loop problems arise as nowhere are the two zero lines joined.

## Cables

Many twin-shielded cables available are unsatisfactory as their shield is too lightly woven and full of holes, allowing interference pickup. Some very flexible guitar cables similarly offend.

To provide a good two-core cable purchase some large diameter good quality coaxial cable like RG8U or RG11U and pull the single inner conductor and polythene dielectric out, and replace with two smaller coaxial cables. The polythene dielectric will slip out of many large coax cables without much trouble, but avoid foam dielectrics. Practice on some short pieces first.

You will need a vyce or similar anchor and some draw wire. Replace with two small coaxials, such as RG174U, attached to the draw wire by their braid, not their inner core.

Do not use PVC hookup wire for the two cores as their loose fit and polyvinyl surface will generate triboelectric

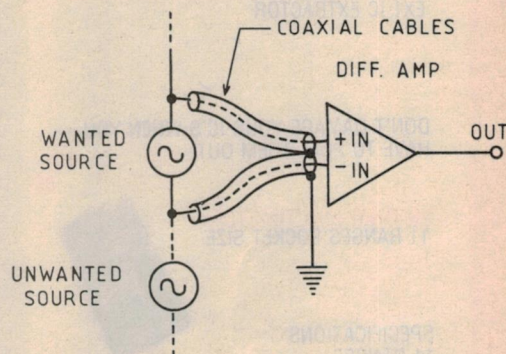


Fig. 14: wiring up the inputs. The two coaxial cables should follow the same path to the voltage source and the shield earthed at one point.

interference voltages through movement (friction).

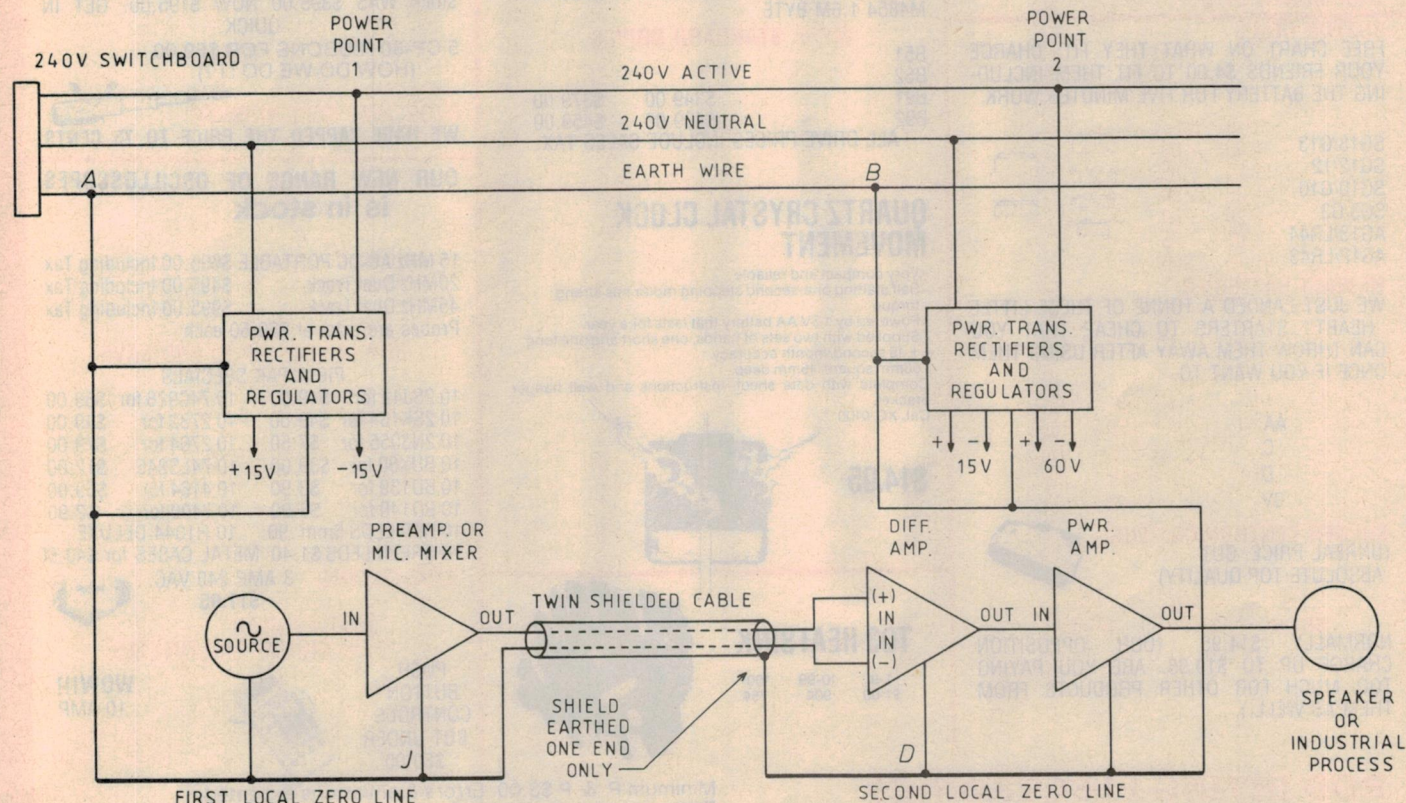


Fig. 15: how to avoid an earth loop when using a preamplifier/mixer that is powered separately from the differential amplifier. Note that the earth (zero) line does not form a closed loop, thereby avoiding mains interference problems.



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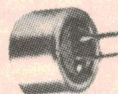
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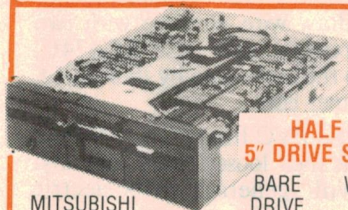
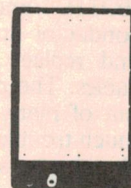
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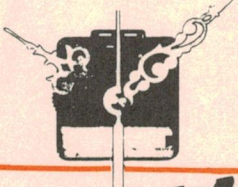
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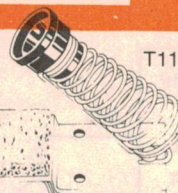
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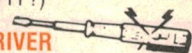
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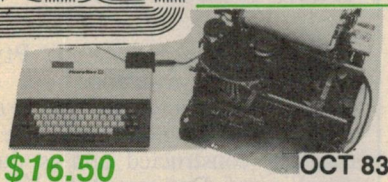
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NOV 83

## Multiprom Interface ETI 673

Run out of ROM room for your Bee. Get this Multiprom interface and increase it by 44K. Don't be constantly pulling out one set of ROMs and adding another. Do it once with this kit. Turn your Microbee into a dedicated machine. Imagine the amount of software you can get into 44K. Naturally this kit is fully socketed. Full documentation including cassette monitor.

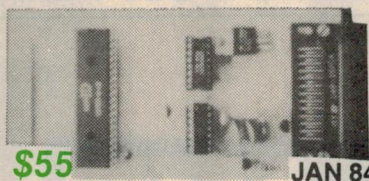


**\$34.50**

FEB 84

## RS232 Interface ETI 676

Fix up the RS232 port so it conforms to standard. Implements the negative going portion of the signal for easier connection of peripherals. Quick, Cheap and Easy.

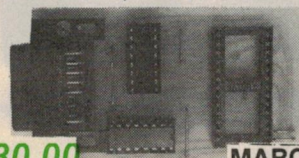


**\$55**

JAN 84

## Serial to Parallel Converter ETI 675

Don't pay 100's of dollars extra for a serial printer. If your parallel port is being used for more important things use your serial port to drive a parallel printer with this kit. Can be used on other computers too. A steal at this price.



**\$30.00**

MARCH 84

## ROM Reader ETI 678

A quick and easy kit to build. 10 minutes work gets you reading ROM's easily, save loading cassettes. Ideal companion for the Eprom programmer.



**\$20.00 (box not included)**

## Radioteletype Decoder ETI 733

APRIL 83

Hook up your Microbee to an SSB receiver and get up to date news and weather. Fiddle with the dial and listen in around the world. Displays direct on the screen. Kit includes all connections.



**\$47.50 (zip socket)**  
**\$38.00**

FEB 83

## EPROM Programmer ETI 668

Want to change some of your monitor routines. How about sharing your own name in the sign on message. This EPROM PROGRAMMER will give you hours of fun. You can put your programs straight into ROM so you don't have to load them in works for 2716, 2732, 2532 and 2764's. Everything provided to start you burning in 2716's straight away.

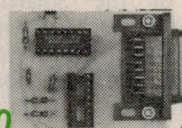


**\$49.50**

DEC 83

## Proportional Joystick ETI 674

Gives excellent control for screen movement. Ideal for Graphics.



**\$15.00**

OCT 83

## Parallel Printer Interface ETI 671

Fixes that short strobe. Allows you to hook up your Microbee to a centronics printer.

Errors & omissions excepted.

10% off  
This Month.

## Software from our Computer Division C-TECH

### MICROBEE SOFTWARE FROM MYTEX

PROGRAM	PRICE
Asteroid Plus	\$22.50
Backgammon	\$17.50
Basic Tutorial	\$20.00
BeeZ80	\$20.00
Chopper	\$20.00
Composer Bee	\$20.00
DeBug	\$17.50
Defender	\$22.50
Emu Joust	\$17.50
Kilopede and Ghost Muncher	\$20.00
King Kong	\$20.00
Logo Bee	\$22.50
Machine Code Tutorial	\$25.00
Meteor Rescue	\$17.50
MusicB	\$20.00
Tape Doctor	\$17.50
Touch Type Tutorial	\$20.00
TRSBee	\$30.00
Wordprocessing Cassette	\$35.00
Wordprocessing Chip	\$39.00

### DREAMCARDS

PROGRAM	PRICE
Poker/Casino	\$14.95
Squirm/Toad	\$14.95
Adventure Pak: Hyperdrive/Caverns	\$19.95
Millipedes/Maze	\$14.95
Decide/Hiroller	\$14.95
Penetrator	\$19.95
Merlin	\$24.95
Mine Drop	\$14.95
Psychotec	\$14.95
Killer Bees (32K only)	\$14.95
Disassembler	\$14.95
Cheapie	\$14.95
Physics Pac 1	\$34.95

### OZI SOFT SOFTWARE COMMODORE 64

PROGRAM	PRICE
Super Skramble	\$24.95
Snakman 64	\$29.95

Super Dogfight	\$24.95
Super Gridder	\$24.95
Grave Robbers	\$19.95
Annihilator 64	\$24.95
Abracalc Disk	\$49.95
Abracalc Cassette	\$45.95
Home Manager Disk	\$39.95
Home Manager Cassette	\$34.95
Monkey Math 64	\$29.95
Bug Blast 64	\$19.95
Spelling Time	\$16.95
Geography Time	\$19.95
Maths Time	\$19.95
Reading Time	\$19.95
Typing Tutor	\$19.95
Master File 64	\$39.95 (disk)
Glaxions 64	\$19.95
Munchman 64	\$19.95
Adventure Pak 64	\$24.95
Metamorphosis 64	\$19.95
Kongo Kong 64	\$24.95

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425 High St., Northcote, Vic. 48-50 A Beckett St., Melb., Vic.  
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436  
Mail orders to P.O. Box 235 Northcote 3070 Vic. Minimum P & P \$3.00.

Please address tax exempt, school, wholesale, and dealer enquiries to: **RITRONICS WHOLESALE**  
1st floor 425 High St. Northcote 3070 (03) 489 7099  
(03) 481 1923 Telex AA 38897



# New Products...

## Product reviews, releases & services

### VHF mobile radio from Robert Bosch

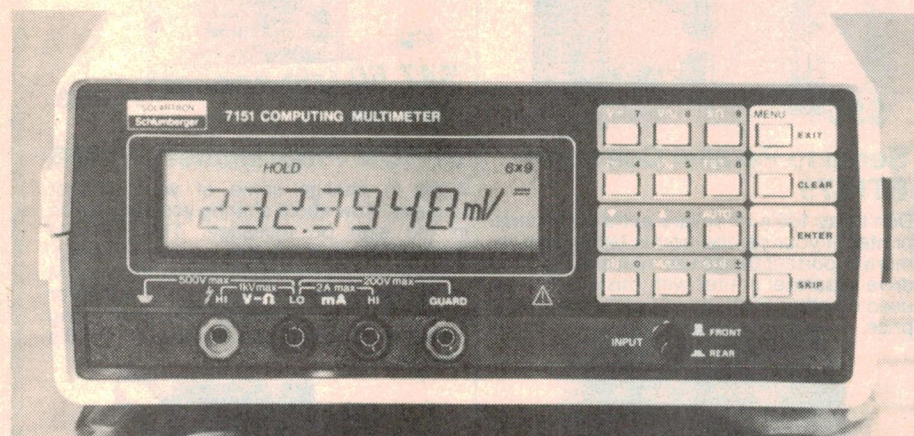
Robert Bosch (Aust) Pty Ltd announce the availability of a new mobile radio that can be used as either a mobile or base station unit. The unit is ruggedly constructed and is dust and splash proof. Designated the KF 84/164 series, they are ideally suited for use by police, fire brigade, emergency services, industry, commerce, and public transport authorities.

The new radios are intended for simplex and semi-duplex operations, and are suitable for data transmissions in

### Wavetek FFT spectrum analyser has memory

Wavetek Rockland Scientific, Inc, has announced the introduction of their Model 5810A real-time spectrum analyzer, which incorporates extensive built-in data reduction to simplify the solution of typical measurement problems in vibration, acoustics, and electronics. The 400 line single channel analyzer also processes and displays new data at a high rate of 17 spectra per second, even while averaging as many as five spectra simultaneously (4 zoom and one baseband). Using a real-time bandwidth of 7.2kHz, the Model 5810A covers frequencies from .0025Hz to 100kHz.

A built-in non volatile memory can store 200 spectra together with all information for later reconstruction of test conditions, including set-up calibration, date, and time. Automatic



### Computing multimeter from Solartron

Tech-Sales Pty Ltd have announced the launch of the Solartron 7151 computing multimeter that combines the calculating power of the microprocessor with the superb measuring capabilities of a 6½-digit multimeter. The Solartron 7151 incorporates two features that have never appeared in any other DMM on the market — an analog output complete with zoom and comprehensive power fail recovery.

The versatile analog output turns any oscilloscope into a graphic display complete with an infinitely controlled zoom. Analog zoom now allows data stored in the Solartron 7151's 500

reading history file to be examined visually, in detail. Power fail recovery allows the Solartron 7151 to resume its programmed tasks, which can be a combination of up to nine user selected programs including clock controlled measurements, when power is restored following a mains failure.

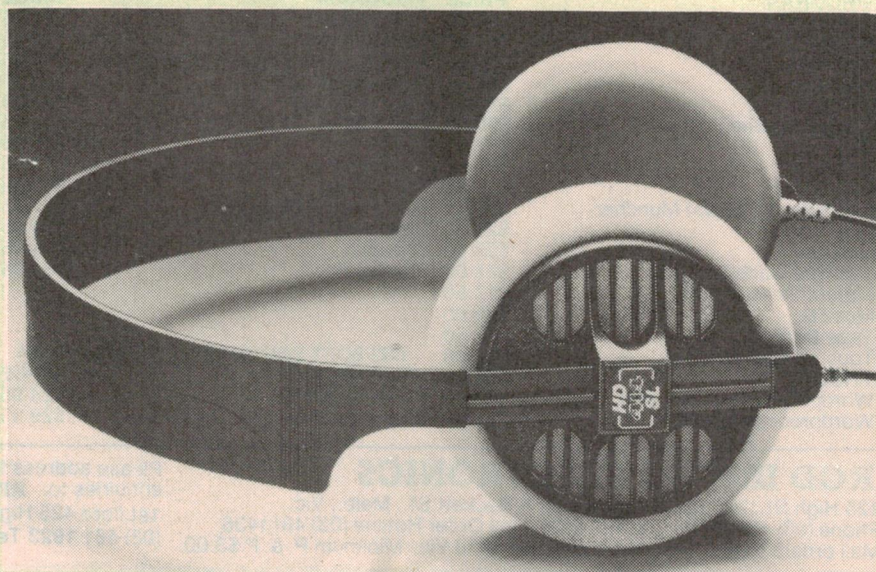
The 7151 offers a comprehensive measuring facility; DC volts from 0.1μV to 1000 volts, AC volts from 1μV to 750 volts, DC and AC current up to 2 amps, resistance from 1 milliohm up to 20M ohms, temperature from -200°C to +600°C and DC measuring accuracy of 0.002%.

For further information contact Tech-Sales Pty Ltd, 12 Maroondah Highway, Ringwood, Vic 3134. Telephone: (03) 879 2266.

### New headphones from Sennheiser

With about 3 million units used and sold the now legendary HD 414 is claimed to have become the most successful hifi stereo headphone in the world. Sennheiser now introduces the successor of the HD 414 which has been designated HD 414 SL. These are of new design which is more comfortable.

Sennheiser can now offer a two-year warranty on all products. This warranty applies to any Sennheiser products bought after 1 January 1984. This warranty is offered on the strength of a purchase document, even if the actual warranty slip only specifies one year.





VHF low band (KF 84) or VHF band (KF 164). All units are available with built-in five tone selective call encoder/decoder for individual, group call and emergency call configurations. The tone calling unit can be programmed so that either ZVEI or CCIR tone groups are available. A field programmable CTCSS encoder/decoder is fitted to all units.

Plug-in modules enable easy maintenance and service. Public address facilities are a standard feature.

For further information, contact David W. Richards, Weston Communications Group Pty Ltd, 31 Coventry Street, South Melbourne, Vic 3205. Telephone: (03) 690 7233.

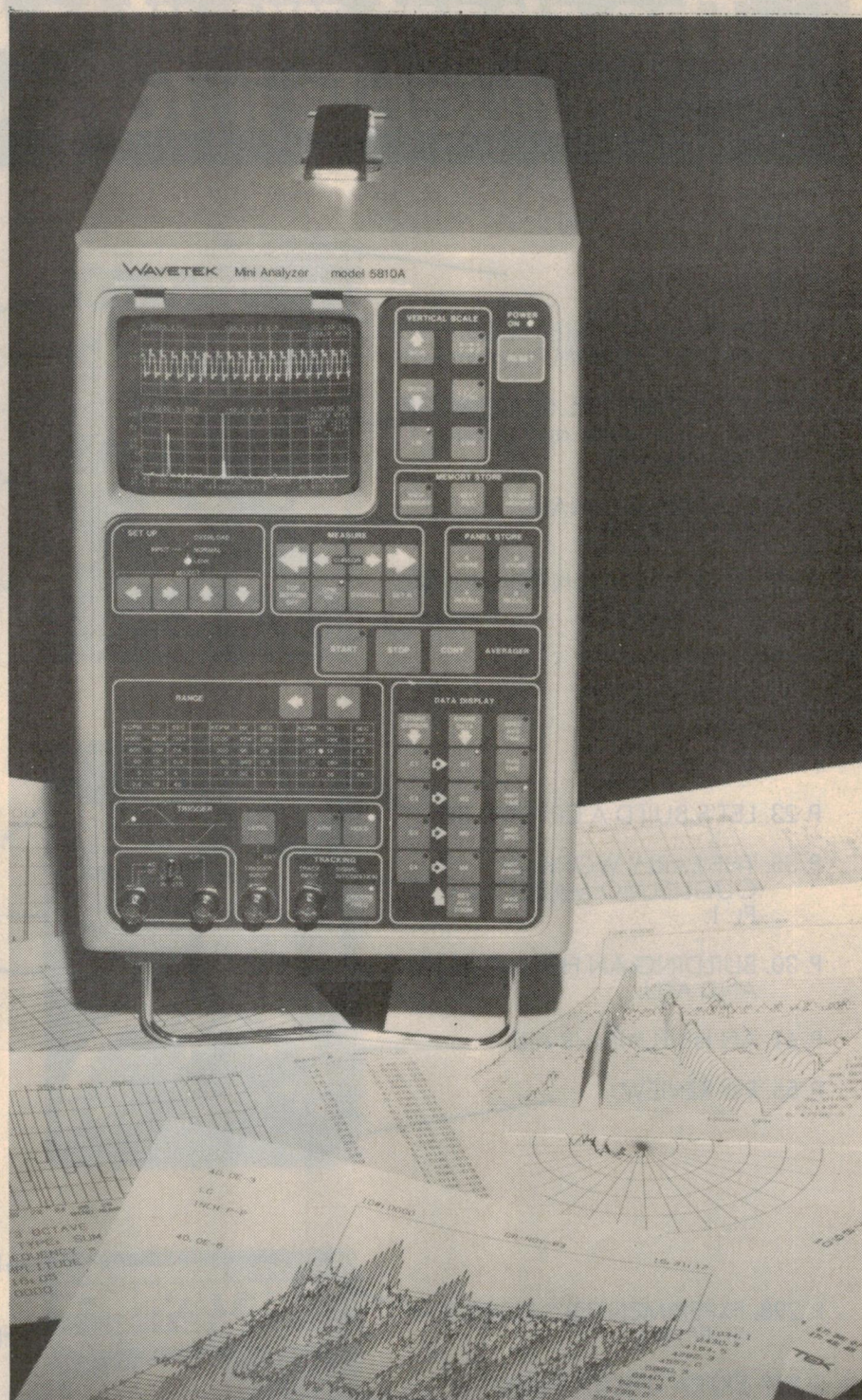
storage at preset time intervals allows unattended logging of long term events such as drift or machine coastdown, or of short term data collection for stack plots.

Built-in data reduction routines permit data analysis in any of 11 different formats. These include stack plots of spectra at time of RPM increments, plots with the highest peak amplitudes and frequencies listed, time histories of four selected frequencies or orders of machine rotation, polar plots of phase vs amplitude for balancing, and optional 1/3 octave and full octave conversions of live and stored spectra.

Portable with on-line data storage, the Model 5810A is designed for use on-site. It also provides high sensitivity and wide coverage for laboratory testing. Simple set up, using any of three stored panels and 12 stored measurement cursor positions, insures repeatability in production or other high volume usage. In addition, the Model 5810A is GPIB compatible for fully automatic data collection and testing.

Computational capabilities of the analyzer include single or double integration in time or frequency domains, PSD calculation, RMS overall or in spectrum regions, and consistent calibration in English or metric units.

Further information can be obtained from the distributor, Scientific Devices Australia Pty Ltd, 2 Jacks Rd, Oakleigh, 3167. Phone (03) 579 3622.



## New power switching device from Motorola

Motorola has introduced a new power switching semiconductor with the high input impedance of a MOSFET and the low internal voltage drop of a bipolar transistor. Called a GEMFET, the new device is intended for use in medium current, high voltage, low frequency

power control applications.

Although structurally similar to a double diffused power MOSFET, the GEMFET's main advantage is its much lower internal resistance in the on state. Resistance is quoted as approximately ten times lower than a comparable MOSFET.

Compared with a bipolar transistor, the GEMFET's lower gate drive current requirements also mean a simpler, more

efficient gate drive circuit, according to Motorola.

The new devices are currently available in four 20A versions with  $V_{dss}$  of 450 and 500V in metal TO-204AA (formerly TO-3) packages and plastic TO-220AB packages.

For further information contact Motorola Semi Conductor Products, 250 Pacific Highway, Crows Nest, NSW 2065.



# The short circuit to heaps of valuable information.

P. 60. SIMPLE PSU.

P. 36. EXPANDING THE VIC 20.  
The 2532 EPROM Programmer.

P. 30. AUDIO SIGNAL GENERATOR.  
Sine, triangular and square wave signals.

P. 23. LOGICAL SIGNAL GENERATOR.

P. 52. INTRODUCTION TO DIGITAL ELECTRONICS.



P. 45. INDUSTRY NOTEBOOK.

P. 34. MICROFILE.

P. 42. SEMICONDUCTOR CIRCUITS.  
Gain controlled preamplifier.

P. 58. MICRO-BUS.  
Focus on micros for the home constructor.

P. 47. PATENTS REVIEW.

P. 23. LET'S BUILD A CRYSTAL SET.

P. 35. THE EARLY WORK OF GUGLIELMO MARCONI - Pt. 1.

P. 30. BUILDING AN HF LINEAR AMP AND ATU.

P. 61. AN HF TUNE-UP AID.

P. 55. PW REVIEW.



P. 52. FOLLOW-UP TO "RTTY WITH THE 2X81".

P. 28. PW REVIEW.

PLUS  
BOOK REVIEWS.  
COMMENTS.  
LETTERS.  
SERVICES AND MUCH MORE.

P. 298. EXPERIMENTER'S POWER SUPPLY.

P. 327. EXTRA UTILITY PROM for the ACORN ATOM.

P. 302. VARI-CAP AM RADIO.  
Personal m.w. receiver.

P. 334. WHY NARROW BAND F.M.?  
Modulation systems compared.

P. 337. BOOK REVIEW.



P. 314. MICROCOMPUTER INTERFACING TECHNIQUES.

P. 330. MASTERMIND TIMER.  
Black Box Project.

P. 345. CIRCUIT EXCHANGE.  
A forum for readers' ideas.

P. 344. SQUARE ONE.  
Beginners' Page.

**NOW AT YOUR NEWSAGENT.**  
\$1.60 each recommended retail price



# New Products...

## Echo sounder from Imark

The new SMR ST-480M echo sounder has been released by Imark Pty Ltd. The ST-480M is a 480ft (146 metre) 4" straight line recorder with a wide viewing screen and a corrosion proof housing. The ST-480M features compact reliable design and the advanced "MEMOLOG" circuitry. The "MEMOLOG" features a combination of analog and memory-type technology to provide high accuracy and definitions. In shallow water ranges, the ST-480M stores all information in a specially designed microchip. In deeper ranges, the ST-480M shifts to analog-type circuitry which allows the operator to select "windows" of a specific depth or bottom structure for detailed inspection.

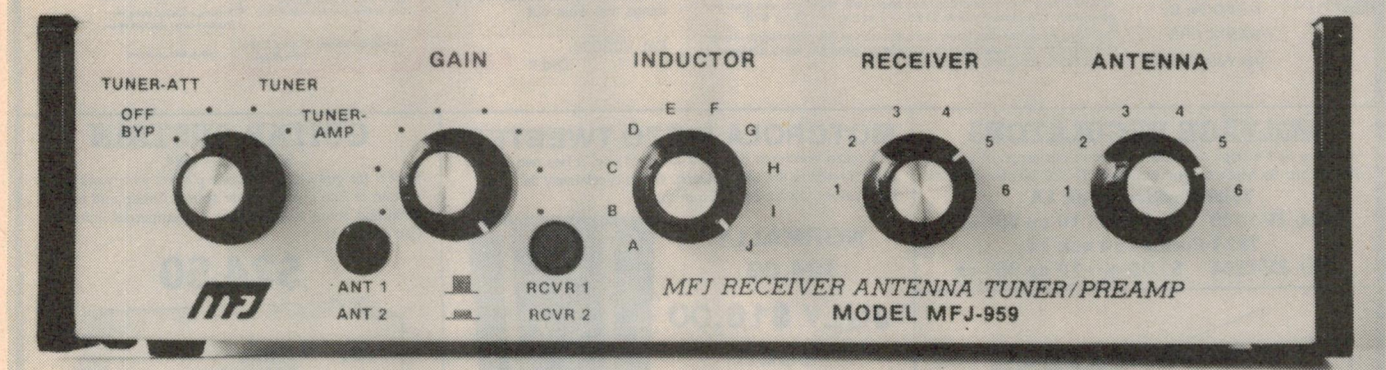
The ST-480M has controls for paper speed, white line, on/off and gain control and switches for the six depth ranges, marker and paper light.



Dimensions are 300mm(W) x 240mm(H) x 76mm(D) including mounting bracket and knobs. Weight is only 3 kgs. The ST-480M is supplied complete with DC cable, transducer and cable, operators

manual and one roll of paper.

Further details are available from the importers: Imark Pty Ltd, 167 Roden Street, West Melbourne, Victoria, 3003. Phone (03) 329 5433.



## Antenna tuner has preamplifier

MFJ Enterprises of Mississippi USA have an Antenna Tuner/Preamplifier designed specially for SWL applications, the Model MFJ-959. This is designed to match a random wire or coax fed antenna down to 50 ohms and then introduce gain to overcome the loss presented by a non-resonant antenna.

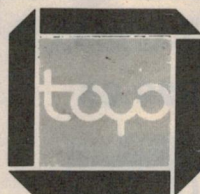
The built in tuner uses a low noise high gain transistor to provide a maximum of 20dB gain which may be varied by the user through a front panel mounted gain control. Switching is provided for selection of two antennas as well as two receivers.

Additional switching is included to allow complete bypassing of the MFJ-959, attenuation with the tuner, tuner only and tuner with amplifier.

In tests recently made on the MFJ-959 using a random wire, as much as eight S-points increase in signal strength was claimed when compared with just the wire on its own. The MFJ-959 requires a power source of 9 to 18 volts and sells for

\$205 plus \$12 p&p.

For further information contact the Australian distributors: GFS Electronic Imports, 17 McKeon Road, (PO Box 97) Mitcham, Victoria, 3132. Phone (03) 873 3777.

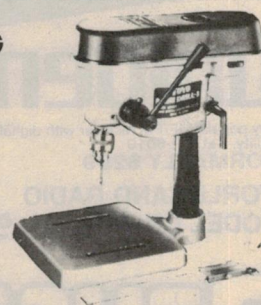


## PRECISION DRILLING AND MACHINING

Throat — 108mm.  
Size — 435mm high.  
Drilling Capacity — 6.5mm max.  
Weight — 5.4kg.

MODEL MDI (6 speeds) 800rpm-3000rpm  
MODEL MDIH (2 speeds) 8000rpm & 12000rpm

Miniature lathe also available.



MELBOURNE MACHINERY CO. (SALES) PTY LTD.  
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(03) 61 2911



**BELOW  
MANUFACTURER'S  
COST!!**

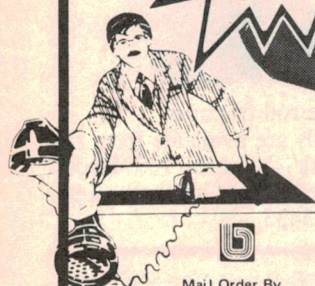
# CAR COMPUTER—PRICE SLASHED! — HUGE SCOOP PURCHASE —

AS REVIEWED  
OCT '82  
EA (p.26-28)  
ETI NOV '82 (p.26)

**ONLY  
\$125  
COMPLETE**  
MASSIVE SAVING  
OF \$74

CAT. XC2010

**NEW IMPROVED  
MODEL!**



Mail Order By  
BANKCARD  
Via Your Phone

**FULL 90 DAY  
WARRANTY**

At \$199 the Voyager Car Computer represented absolutely outstanding value for money. No one else had such a low priced, **FULL FUNCTION** car computer. The Voyager is the only low-cost unit that will give you full consumption (the most important feature in a car computer) in both metric litres/100km AND good old **MILES PER GALLON!**

At \$199 many, many hundreds have been sold. **NOW** you can grab one **absolutely complete** for only \$125 — a saving of 37% or \$74!

The Voyager comes absolutely complete with all fitting hardware — even down to a roll of insulation tape! Installation generally takes between 4 and 6 hours depending on vehicle.

The Voyager is available from the following dealers at your convenience:

Jaycar Sydney (City) 264 6688/267 1614  
Jaycar Concord 745 3077  
Jaycar Carlingford 872 4444  
Jaycar Hurstville 570 7000  
Zap Electronics Parramatta  
Hornsby

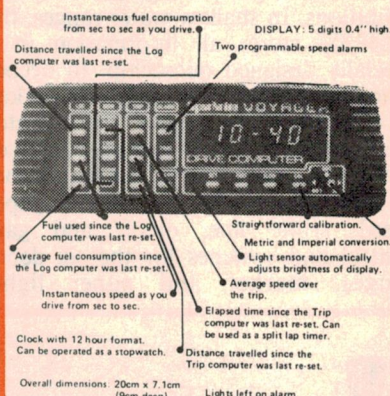
or by mail order to:  
Jaycar  
Box 185  
Concord 2137

Rod Irving (03) 347 9257  
Melb A'Becket St (03) 489 8131  
Northcote (09) 328 1599  
Altronics Perth

**Spare Flow Sensors:** Jaycar will be supporting this product for many years to come. To avoid problems changing cars, why not buy a spare fuel flow sensor? They are about the only things that wear out

Cat. XC2036 ONLY **\$29.50**

## VOYAGER OPERATING FEATURES



## VOLTAGE REGULATORS

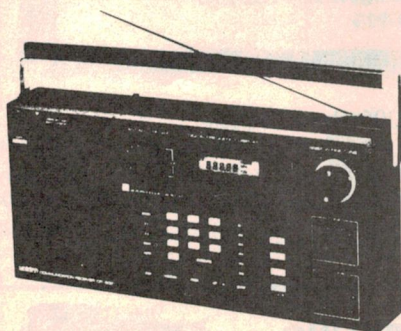
We have had a large demand to expand our range of Voltage Regulators. So here's two new ones in TO-220 flat plastic packs.

**7809 Positive 9 volt 1A**

Cat. ZV-1509 \$1.05 ea - 10 up 95¢ ea

**7824 Positive 24 volt 1A**

Cat. ZV-1524 \$1.05 ea - 10 up 95¢ ea



**uniden®**

Very popular HF/FM receiver with digital readout and scanner facility. Cat. DR-6010

**NORMALLY \$299**

**WORLDWAVE RADIO  
MODEL CR-2021**

**\$239  
SAVE \$60**

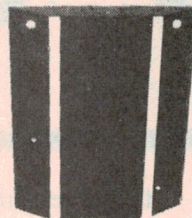
**Jaycar  
ELECTRONICS**

## MOTOROLA PIEZO TWEETER

This piezo tweeter is designed for Hi Fi use. It has two drivers incorporated in the one housing, which is relatively flat. Dimensions: 120 x 95 x 15mm thick

**NORMALLY  
\$24.00**

**JULY \$16.00  
each  
LIMITED STOCK**



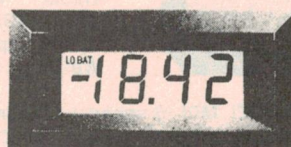
## LOW COST 3½ DIGIT LCD PANELMETER - DPM10

This DPM is electrically identical to the DPM that is used in many LCD kits. We imported this unit by mistake and do not wish to keep it as part of our normal range. If you want a quality 3½ digit DPM at an unrepeatable price - **HURRY!**

Equivalent to units costing \$39.95  
Specifications similar to DPM50

Cat. QP-5516

**ONLY \$29.95**



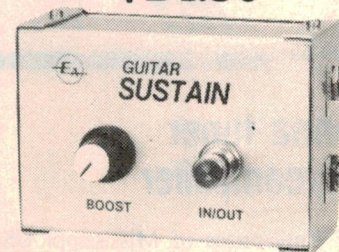
**SEE OUR DOUBLE  
PAGE ADS FOR FULL  
JAYCAR DETAILS**

## GUITAR SUSTAIN

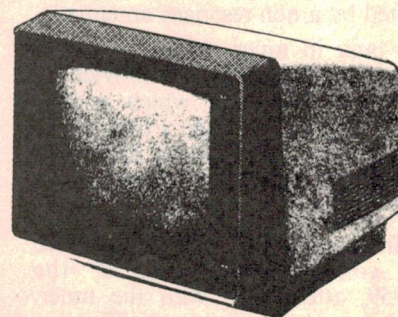
SEE EA JULY 1984

Perfect for guitarists and bass players who want more sustain or bite in their guitar sound. Cheap and easy to build and about a ¼ the price of commercial units. Cat. KA-1553

**\$24.50**

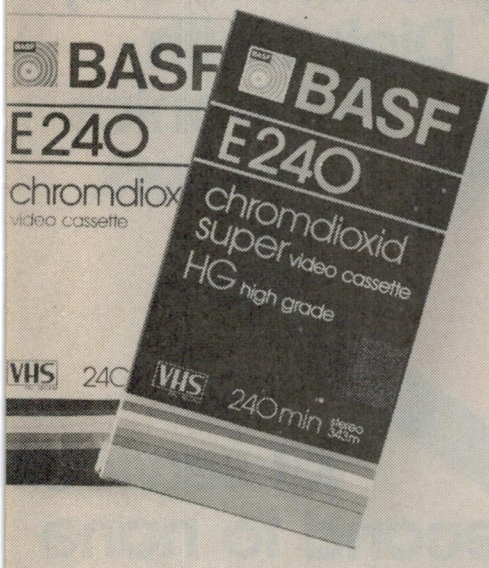


**GREEN SCREEN  
MONITORS - BACK!!**  
Micron Series 2 - Non glare  
screen - Cat. XM-4500 **\$219.50**





## New Products...



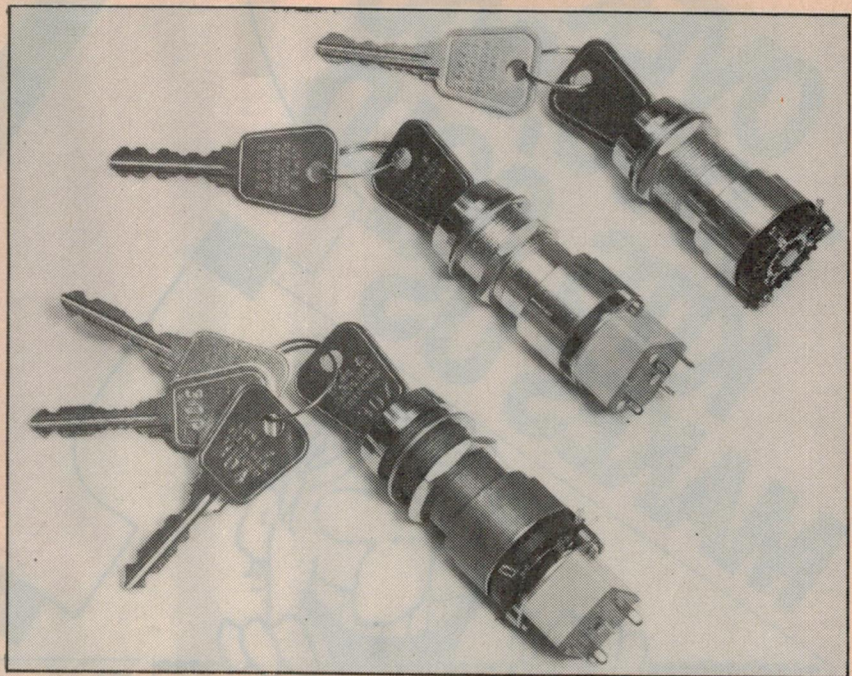
BASF has now released the E240 super high grade chrome dioxide video tape which gives a four hour playing time on a VHS recorder. The new tape is keenly priced at \$16.99 which means that it is actually cheaper on a tape per dollar basis than premium grade and even the "cheapie" 3-hour tapes.



### Ellistronics air powered screwdrivers

The APD series screwdrivers from Ellistronics are engineered to handle a broad range of fastening and unfastening applications from delicate instrument assembly to electronic chassis and cabinets. These precision tools are built with a gear type driving mechanism that provides exceptional power from within an extremely compact, lightweight housing. They feature automatic start with a forward push of the bit upon contact with the screw, instant reverse, torque control and low noise level which enhances the use of these screwdrivers in a laboratory or cleanroom environment.

A complete inventory of bits and spare parts is available from Ellistronics Pty Ltd, 797 Springvale Road, Mulgrave, Vic 3071.



### Security key switch

C & K Electronics (Aust) Pty Ltd has available a new "limited access" security key switch from Lorlin Electronic Co, of England. The lock mechanism offers high security with an 8 disc double entry tumbler allowing the key to be inserted either way.

This lock allows four keyholders to each have access to a different number of switch positions. For example, key "A" offers 2 positions, key "X" offers 3 positions, key "Z" offers 4 positions, while key "P" offers 5 or 6

positions. All indexing is at 60° steps. All keys can be withdrawn in position 1 and position 2, while other positions trap the key and prevent removal. The switchlock is normally supplied with one each of the four keys mentioned. Keys are random selection and offer 2,000 key combinations.

Electrical switch combinations are limited only by the user's imagination and can be built up to customer specification at time of order.

For further information contact C & K Electronics (Aust) Pty Ltd, 15 Cowper St, Parramatta, NSW 2150. Phone (02) 635 0799.

### Sheridan Hobbies is Sydney's newest model shop

Barry Sheridan, well known to customers of Sheridan Electronics, has set up Sydney's newest model shop, Sheridan Hobbies, just a few doors down and across the road from the Sheridan Electronics Redfern store.

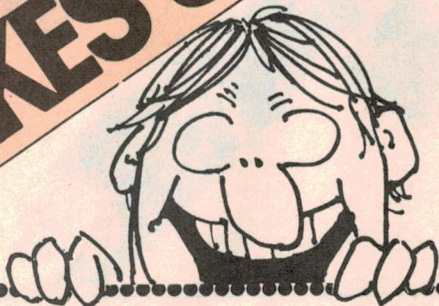
Barry has been an enthusiastic

aeromodeller for many years and plans to bring the same quality and service to the modelling field as the company already provides for electronics hobbyists, both over the counter and in the mail order area. Sheridan Hobbies is at 113B Redfern St, Redfern, NSW.





**OVER  
1,000,000  
KITS SOLD  
MAKES US NO. 1**



# FUNWAY 3

## Bonus Pack



**ONLY  
\$24<sup>90</sup>**

And what value!  
Buy this pack with two  
of the most popular  
kits in the Fun Way  
Three book... and we  
throw in the book FREE!

Yes, you get both the Electronic Cricket project plus the Miniature Amplifier project together valued at \$24.90, and as a bonus, the Fun Way Three book itself at no extra charge!!  
Fantastic gift idea... also makes ideal school project material. And this book gives details on how to really dress up your kits for top presentation... and top marks.

Whether you want to learn more about electronics, or just have fun building interesting circuits, you won't do better than Fun Way Into Electronics. And with Fun Way 3, you really move up into the electronics 'big time'. This fantastic bonus pack will get you started!

Cat K-2670

### Lil Pokey

It's a barrel of fun to play. And you don't risk losing your shirt like the real thing.  
Cat K-2662

**\$19<sup>95</sup>**



### Light and Sound

Another multi-talented project. Sound effects, flashing lights - continuity tester, Morse code oscillator. Cat K-2665

**\$8<sup>95</sup>**



### Mini Colour Organ

Like a disco - but battery operated so it's safe! Connect to your radio, etc, for a LED lightshow.

**\$12<sup>95</sup>**

Cat K-2664



### Minder

A multipurpose project for the car. 'Lights on' warning, 'door open' warning plus a pseudo burglar alarm.  
Cat K-2660

**\$7<sup>95</sup>**



### Fluoro Starter

**\$4<sup>50</sup>**



This substitute electronic starter solves the problem of lights going blink, blink, blinky blink and gives you a smooth rapid start EVERY time you switch on. And all the parts are housed in a starter case! Outlasts conventional starters by far!  
Cat K-3082

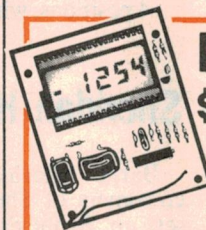
(Does not include starter case.)

### PLAYMASTER Graphic Equaliser

**\$129**



Get total control and flexibility with your sound system. With cut and boost of up to 13dB per channel you can make up for deficiencies in your listening area or sound source or even create special effects. Features professional quality brushed aluminium front panel.  
Cat K-3500



### LCD PANEL METER

**\$29<sup>50</sup>**

A versatile accurate panel meter using a large liquid crystal display for low power consumption. The PC board design allows for maximum flexibility to cater for varied mounting arrangements. The low cost makes it ideally suited as a readout device on many projects, at both amateur and professional level. Cat K-3450

### Two Up

**\$9<sup>95</sup>**

Australia's national game - now done electronically because King George pennies are hard to get!  
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### MINI SYNTH

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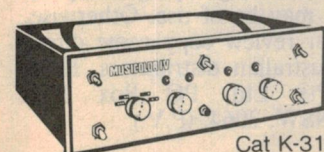
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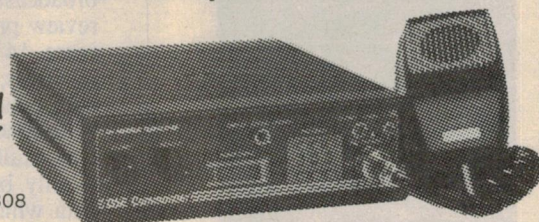
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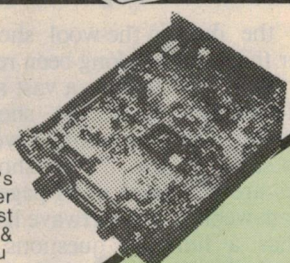
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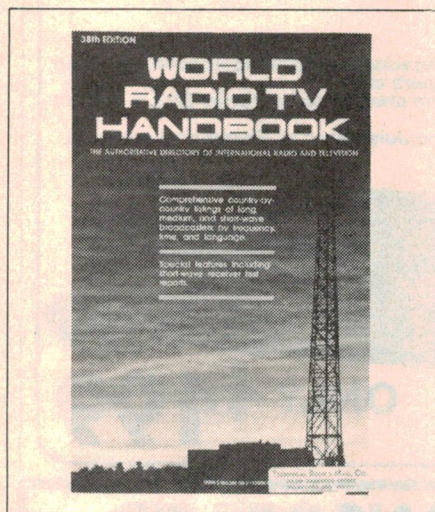
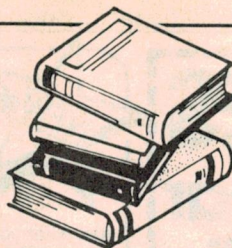


R783

See page 30 for full address details



# Books & Literature



## World radio TV handbook

**WORLD RADIO TV HANDBOOK:** Edited by A. G. Sennitt. Published by Billboard Ltd under licence to Billboard A.G., Denmark. Volume 38, 1984, 608 pages, 230 x 145mm, illustrated with maps and photographs, soft covers. Recommended Australian price \$27.95.

For the dyed-in-the-wool shortwave listener this book has long been regarded as the "bible". It contains a vast amount of information concerning shortwave broadcasters world-wide and it would be safe to say that few, if any, shortwave services are not listed in its pages. And for the newcomer to shortwave listening, who has a hundred questions to be answered, this book will be invaluable.

It starts with an index of over 220 countries, from Afghanistan to Zimbabwe, with page numbers for both radio and TV services. Between them, these references list the domestic AM and FM services, domestic and overseas shortwave services, and TV services, giving each station call-sign, frequency, management, and address. In the case of shortwave services it gives the transmission time/frequency schedules as they were known at press time.

There is a chapter on how to use the Handbook, presented in English and three other languages. This chapter in itself will provide an excellent introduction, for the beginner, into the mysteries of shortwave listening.

As well as the basic lists already mentioned, there is a chapter on WARC 84, solar activity and predicted reception conditions for 1984, tables of most suitable bands for 1984, various broadcasting organisations, equipment review providing detailed comparison of some 14 shortwave traveller's portable receivers, plus some of the larger type, and several smaller items such as world-wide time charts, maps etc.

Overall it is an impressive publication, if only because of the vast amount of data which has been collected. But it is also a very practical publication for both the regular shortwave listener and the newcomer, particularly for our migrant population, who may be anxious to keep in touch with an overseas country. And at another level, it could prove valuable to anyone wishing to study radio and TV statistics of individual countries or world-wide.

Our copy came from Technical Book and Magazine Co Pty Ltd, 289 Swanston St, Melbourne, 3000. Sole New Zealand agent is Arthur T. Cushen, 212 Earn St, Invercargill. (P.G.W.)

## Fundamentals of microprocessors

**FUNDAMENTALS OF MICROPROCESSORS** by Henry O. Daley. Hard covers, 166 x 241mm, 261 pages, illustrated with diagrams. Published by Holt Rinehart and Winston, N.Y. 1983, \$51.95, ISBN 0-03-059934-2.

This is very much a "fundamentals" book, intended for use as a textbook in introductory courses on microprocessors, judging by the format. Each chapter begins with a list of "learning activities" and "objectives" and concludes with a series of exercises (with answers), review questions and further references.

Number systems are covered in the first chapter, digital logic and more advanced circuits in chapters two and three, and microprocessor structures in chapter four. Following this introduction are chapters on input and output, interfacing and peripheral devices, machine code and assembly language, a guide to the 6800 microprocessor and applications and a survey of other microprocessors, including very brief sections of 16-bit processors.

Three appendices cover the 6800

instruction set in detail and the book concludes with a comprehensive index. The book has nothing to offer the hobbyist as all the material can be found in a cheaper and more complete form in other publications. For the teacher or lecturer looking for a class textbook for use in conjunction with lectures and practical work with the 6800 the volume may be worth a look.

Our review copy came direct from the Australian distributors Holt-Saunders Pty Ltd, PO Box 154, Artarmon, NSW. (P.V.)

## The S-100 bus handbook

**THE S-100 BUS HANDBOOK** by Dave Bursky. Soft covers, 214 x 279mm, 257 pages, illustrated with diagrams and photographs. Published by the Hayden Book Company Inc. 1980. \$28.95. ISBN 0-8104-0897-X

This book is an interesting illustration of the speed at which the microcomputer field changes. Although published in 1980, it is already considerably dated, dealing as it does with the S-100 bus system and the 8080 microprocessor. Even the IEEE-496 standard, derived from the S-100 bus structure, is referred to as the "proposed new bus standard", while many of the circuits and examples given are drawn from the Im sai microcomputer introduced in 1978.

The contents are fairly typical of this sort of hardware manual, with a basic introduction to computers and microprocessors, binary mathematics, Boolean logic and digital electronics in the first three chapters, and separate chapters on the S-100 bus and motherboards, computer memory systems, input and output interfacing, mass storage, interfacing and troubleshooting.

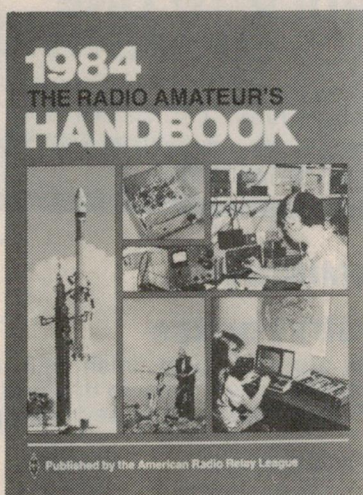
The longest chapter covers the machine language programming of the 8080 microprocessor, and while excellently done, suffers from the datedness which affects the entire book. Lengthy appendices are provided on reference books, suppliers of S-100 bus systems (United States only, and current in 1980) and circuit diagrams of commonly used S-100 bus boards (again dated).

If you have an S-100 system you will probably already have this book or others like it. If you don't, and for some reason are considering buying one, parts of the book may be of use. Otherwise, forget it. Our review copy came direct from the Australian distributors, Holt-Saunders Pty Ltd, PO Box 154, Artarmon, NSW, 2064. (P.V.)



## The radio amateur's handbook

**THE RADIO AMATEUR'S HANDBOOK, 1984** (Sixty-first Edition): Published by the American Radio Relay League, Newington, USA. Soft covers, 648 pages, 276 x 209mm. Illustrated with many line drawings, photographs, circuits, graphs and tables. ISBN 0 8 7 2 5 9 0 6 1 5. Recommended Australian price, \$22.95.



This is the latest edition of the famous "ARRL Handbook" as it is popularly called. At first glance it appears very similar to the editions immediately preceding it and, to some extent, this is inevitable. Much of the material in a book of this kind is basic; fundamental principles, laws of physics, formulas, tables, and so on, which provide the basic understanding of electronics as it applies to amateur radio communications.

On the other hand, the editors point out that, where applicable, the book has been revised and up-dated. Among the changes listed are those involving the Specialised Communications chapter, including the launch of OSCAR 10, spread spectrum techniques, AMTOR RTTY, and packet radio.

The interference chapter has been revised, as a result of new FCC laws aimed at reducing interference by, or to, amateur equipment. There is an updated section on classes of amplifier operations, from class A to class E, plus a redesigned and improved index. And a new set of filter tables gives component values for high-pass, low-pass and band pass passive filters.

At a more practical level there are several new construction projects, including high power amplifiers for both HF and VHF transmitters (not applicable to the Australian scene). There is also a design for a "Deluxe Audio Filter" which would seem to be an ideal project to introduce the reader to modern circuit technology and filter philosophy, while producing a worthwhile device to improve receiver performance. Most projects feature same-size printed circuit board patterns, suitable for copying, with separate component overlays.

There are 23 chapters in all. Amateur Radio, Electrical Laws and Circuits, Radio Design Technique and Languages, Solid State Fundamentals, AC Operated Power Supplies, HF Transmitting, VHF and UHF Transmitting, Receiving Systems, VHF and UHF Receiving Techniques, Mobile, Portable and Emergency Equipment, Code Transmission, Single Sideband, Frequency Modulation and Repeaters, Specialised Communications Systems, Interference, Test Equipment and Measurements, Construction Practices and Data Tables, Wave Propagation, Transmission Lines, Antennas for High Frequency, VHF and UHF Antennas, Operating a Station, Vacuum Tube and Semiconductor Tables.

At the recommended price this book must be one of the cheapest serious textbooks on the market today and, considering its size and the mass of material it contains, by far the best value offering. And even those not interested in amateur radio as such will still find a lot of useful basic principles, data, and tables not readily available elsewhere.

Our copy from Technical Book and Magazine Company, 289 Swanston St, Melbourne, Victoria, 3000. (P.G.W.)

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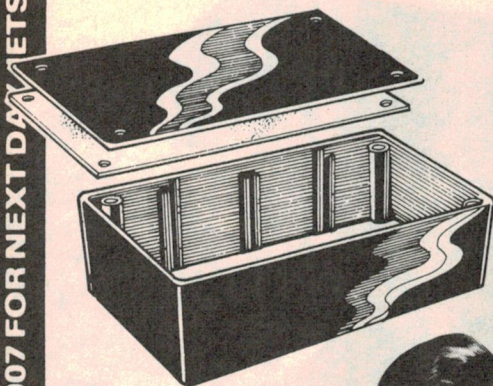
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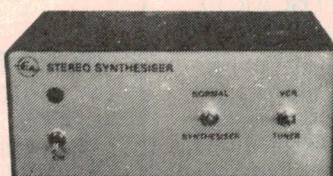
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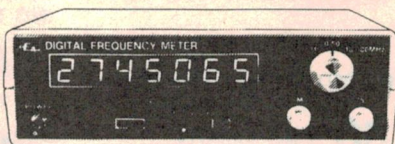
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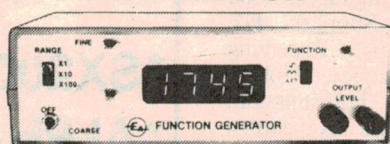
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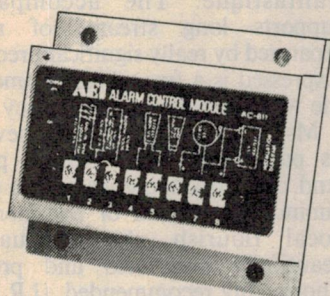




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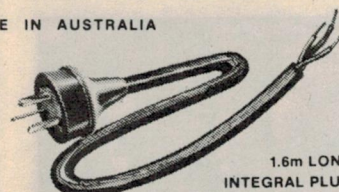


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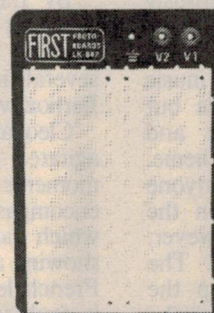
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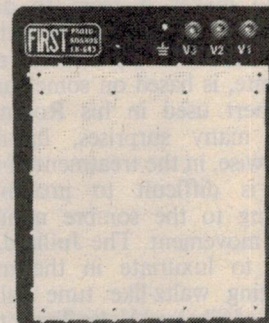


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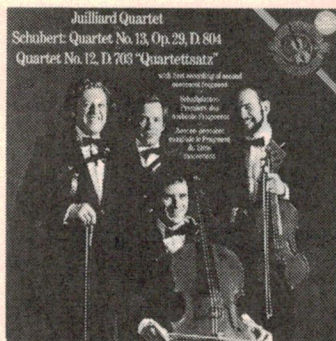
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## REVIEWS OF RECENT

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### SCHUBERT

**Quartet No. 13 in A Minor, Quartet No. 12 in C Minor (Quartet Satz) Juilliard String Quartet. CBS Masterwork Analog Disc 74107.**

It is strange to think that this sweetly melodious quartet was Schubert's first to be performed in public and published although he had already composed 18 other quartets and pieces in plenty before that. The sweetness of the first movement is not devoid of drama. The Juilliard take it a bit on the slow side as if determined not to let it cloy.

The analog engineering, by the way, is a little on the dry side and the slowish tempo makes it seem to dangerously approach prolixity to all but the most romantic ears. The second movement, andante, is based on some earlier music Schubert used in his Rosamunde but with many surprises, harmonic and otherwise, in the treatment of the theme.

It is difficult to imagine anyone dancing to the sombre minuet in the third movement. The Juilliard, however, seem to luxuriate in the mood. The haunting waltz-like tune calls up the mood of Sibelius' Valse Triste though the music is quite dissimilar.

You have a brilliant contrast in the Finale which starts modestly, picks up in speed while always remaining amiable, is momentarily shadowed by a more serious second subject but returns joyously to finish. The dynamics are everywhere restrained within the true bounds of chamber music.

The Quartet Satz (satz is simply the German for movement) introduces

intense drama right from the pianissimo beginning. All through the recital and here in particular the Juilliard command the greatest respect for the refinement of their dynamic changes. Listening to it for the first time I felt I couldn't afford to miss a single note. The recital ends with the few bars which are all we have of the unfinished second movement. (J.R.)

### BERLIOZ

**Cleopatra (Scene Lyrique). Herminie (Scene Lyrique). Janet Baker (mezzosoprano) with the London Symphony Orchestra conducted by Sir Colin Davis. Philips analog disc 9500 683.**

Many of France's finest composers — and artists — were either never awarded the coveted Prix de Rome or were reluctantly awarded it only after several tries. What this means you must work out for yourselves. Discussion of it in the space available here would be unprofitable.

I mention this because both the pieces under review were written for the Prix de Rome and turned down. Herminie, by far the inferior of the two, did scrape a second, perhaps because it was more conventional than the powerful, daringly original Cleopatra. Berlioz learned something from that.

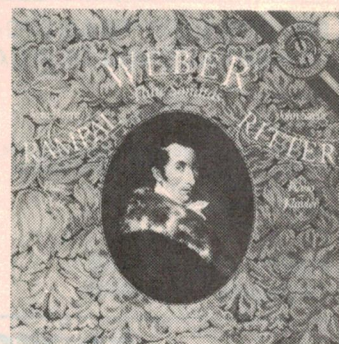
By the way, quoting David Calirs' excellent sleeve notes, Balzac was never elected, Victor Hugo had to stand several times, Ravel failed to win it and Berlioz won it only at his fifth attempt.

Cleopatra is a great "Scena". From the agitated opening to the superb dying moments it rivets the attention. It encompasses a very wide vocal range which Janet Baker handles effortlessly, showing at all times mastery of the long French legato. Everywhere the balance is faultless and the orchestral playing first class.

Great chordal passages and the strangely unearthly calling on the "great pharaohs" are spine chilling in the strength of their drama. And once or twice Ms Baker uses what is almost a parlando without any hint of artificiality. Her diminuendo at the end is something to repeat endlessly. The analog sound is good enough to appreciate to the full the genius of Berlioz' orchestration.

Herminie is in a different class altogether. Although an early work the composer's technique is already assured. You will immediately spot that the opening, and indeed the chief theme, is that featured in the Symphonie Fantastique. The accompaniment supports long streams of melodies separated by really significant recitatives. Expressed is a free range of emotion all the way from despair to ecstasy.

Ms Baker's splendid voice never loses its purity under the fiercest pressure. And this work too ends with a thrilling diminuendo instead of the more usual vocal flourish. An unusual disc, beautifully performed and presented. Thoroughly recommended. (J.R.)



### WEBER

**Six Sonatas transcribed for Flute and Piano. Jean-Pierre Rampal (flute) and John Steele Ritter (piano). CBS Masterworks Digital Disc D37842.**

The well-deserved fame and popularity of James Galway should not tend to make one forget that there are several other fine flute players knocking about this planet. Among them is Jean-Pierre Rampal, always elegant with an assured technique ready to meet any challenge and keen perception of the true significance of anything he plays.

The six sonatas on the disc under review were originally composed for violin and piano with the main interest concentrated in the piano part. Indeed Weber marked them "for piano with



violin obbligato". By the way, no name of any transcriber appears anywhere on this production. All are brief, and apparently meant for domestic rather than public use.

In the first movement of No. 1 the flute has a mainly repetitive role with the whole piece beautifully put together. The second, a Romance, is a flute solo, simple but attractive and in no way commonplace.

The third is a jaunty Finale showing excellent co-operation and balance between the two players.

All are played with excellent tone, fine technique and exquisite taste though none has sufficient weight to be correctly described as a sonata. Sonatina would be more appropriate.

A "Carratere Espaguola" opens the second sonata. Its Spanish effect is achieved by an elementary rhythm in the piano part which here has echoic functions. An eloquent Adagio follows and in the third movement an Air Polonaise, not the dance of that name, but a spirited Finale.

Sonata No. 3 starts with an Air Russe which doesn't sound very Russian to our ears but which does give Weber a chance to use, at that period, some very advanced harmonies. The Finale is a fast Rondo which gains speed as it goes along until it is racing very quickly indeed. It is one of the three sonatas in only two movements.

No. 4 is also in two movements and one can here notice increased difficulty in the flute part right away. The piece, though very brief, is always interesting with a curiously abrupt ending to the first movement. There is not much difference between the tempos of the two movements marked moderato and rondo but the second speeds up later to a very brisk pace.

No. 5 opens with an Aria from the Opera Silvano in typical aria form showing the excellence of the cooperation between the two players. After the statement of the Aria it turns into a rather inflated set of variations. It is the longest movement in the set, is very difficult and should not be attempted by any novice. Lovely smooth phrasing characterises the Siciliano Finale.

The last sonata is on a bigger scale than the others. The first movement is a fine allegro con fuoco — fiery indeed — the second an impressively solemn but never dull Largo, very attractive throughout its short length. It leads straight into the Finale, a spirited Polacca.

If you're looking for something unusual and at the same time elegant, this disc should suit you nicely. (J.R.)

## CHOPIN

**Volume No. 6 in the series of his complete works. Vladimir Ashkenazy (piano) on a Decca Digital Disc, SXDL 7593.**

Ashkenazy continues his complete recording of the Chopin oeuvre with Vol 6 which contains a happily assorted collection of some well-known and not so well-known pieces. All of them were written between 1838-41, a period when Chopin was in the middle of his affair with George Sand. It was a comparatively happy period for him, if anyone who had to live with George Sand could be truthfully described as happy.

The works are all mature, indeed they include one of Chopin's finest creations. He starts the recital with Impromptu No. 36, carefully played to avoid any hint of the boudoir. Everything is serious and well considered with no hint of the dainty Pachmann school. It is all very impromptu, never more so than when scales run up and down over a bass melody before the final reprise of the first theme.

The first bracket includes two Nocturnes, Op 37, one in G Minor the other in G Major. Ashkenazy makes no effort to prettify his touch which always remains firm. Nor is there anything dreamy in either piece. Whether they are really nocturnal is doubtful, but they sound lovely.

This firmness of touch also lingers in the G major especially in the exquisite thirds and sixths which give way to a beautiful swaying Barcarolle-like melody full of inspired chromaticism. Next comes the Waltz, Op 42, taken at a brisk tempo which reveals the smooth perfection of Ashkenazy's great technique. Changes of tempos and rhythms are engrossing.

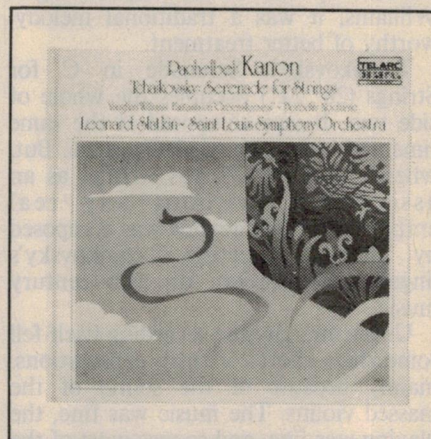
Next comes the great Polonaise, Op 44, in passionate nationalistic style, its implacable progress interrupted by a full Mazurka, also fervently nationalistic. The ostinatos are handled in a masterful way that I have never heard equalled.

The following Allegro de Concert was originally intended as part of a piano concerto which Chopin neglected to complete. It is hard to imagine the march-like theme in a combined piano and orchestral home but Ashkenazy's performance is a brilliant example of virtuosity and the Finale is very exciting.

The Sostenuto in E Flat Major is really a slow waltz and a delicious one at that. Its mood is lamenting but never snivelling. Indeed it has a quite nationalistic tone. Then comes another Mazurka, this time in A Minor. And the

recital ends interestingly with Three New Studies none of which appears in either book of Studies.

They are mysteriously neglected nowadays, perhaps because they are so short. They would make splendid encores. The first and second solve problems of rhythm, the third is very difficult indeed in its combination of staccato and legato, though you wouldn't think so the way Ashkenazy plays it. (J.R.)



## STRINGS TO THE FORE

**Pachelbel — Kanon; Borodin — Nocturne for String Orchestra; Vaughn Williams — Fantasia on "Greensleeves"; Tchaikovsky — Serenade in C for strings. The Saint Louis Symphony Orchestra conducted by Leonard Slatkin. Telarc stereo LP, DG—10080. (From PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4022.)**

On the last occasion that I reviewed a recording featuring the Pachelbel Canon (Feb '83) it was a most impressive transcription by the Canadian brass on an RCA LP. This time around, the recording features the St Louis Orchestra, in particular the string section, which was the pride of their former conductor, the late Walter Susskind and, more recently, of Leonard Slatkin.

In the detailed jacket notes, the writer explains the structure of Johann Pachelbel's 17th century Kanon (or Canon) in which all the parts use the same basic melody but starting at different times in a different register and even a different pitch. It's like a complicated round in which the exercise can be as ingenious as possible, must obey all the rules, yet finish up pleasing music, as distinct from a clever exercise. The Pachelbel Kanon in D (6' 01") is a classic example.

This is followed by Alexander Borodin's beautifully melodic nocturne



# Records & Tapes

(7' 09"), which is actually the slow movement of his second quartet.

"Greensleeves", unfortunately, needs no introduction to urban dwellers who have to endure highly distorted versions from itinerant ice-cream vendors. Nevertheless, it dates back to at least 1575 and was used by Shakespeare and misused by others. To Ralph Vaughn Williams, it was a traditional melody, worthy of better treatment.

Tchaikovsky's *Serenade in C for Strings* (28' 22") occupies the whole of side two. It was composed at the same time as his famous 1812 Overture. But, whereas the "1812" was written as an assignment, without any real enthusiasm, the *Serenade* was composed by choice, reflecting Tchaikovsky's lingering admiration for 18th century music.

Unfortunately, the recording itself fell somewhat short of my expectations, mainly because of the sound of the massed violins. The music was fine, the playing was fine, and so was most of the instrumental and orchestral sound. It was just the violins playing forte that tended to acquire a congested "edge", unfortunately not uncommon in orchestral recordings.

The effect might pass unnoticed by many, in their preoccupation with the music but it could disappoint some hifi enthusiasts. (W.N.W.)



## SPRIT OF AMERICA

**Dvorak: Symphony No. 9, Op 95 "From the New World".** Carnival Overture, Op. 92. Played by the Vienna Philharmonic Orchestra conducted by Lorin Maazel. Compact disc, DG, 410 032-2.

Now available on compact disc, this is a relatively recent performance of a

much recorded symphony from a very popular composer, Anton Dvorak. It was, in fact, his ninth and last, receiving its first performance at Carnegie Hall in December 1893.

Born in Bohemia in 1841, Dvorak received his early musical training at the Prague organ school but, at age 20, became violist for the National Theatre. In his 30s, he turned to composing and made his name with such scores as *Slavonic Dances*, *Slavonic Rhapsodies* and the *Czech Suite*.

The period 1892-95 was spent in America as Director of the National Conservatory of Music in New York. Founded by Mrs Jean Thurber, its purpose was to encourage the composition of characteristically American music, hopefully of the classical genre. It was an objective with which Dvorak developed considerable empathy, as he became conscious of the uniquely different culture of the "new world" involving Indians and the West, Negroes, the writings of authors like Henry Wadsworth Longfellow — right through to ships and trains!

It was in this context that Dvorak composed his ninth symphony which he personally described as "From the New World". But while freely admitting the source of its inspiration, he was quick to deny that it was primarily an adaptation of American folk melodies.

"Leave out that nonsense", he said, "about my having made use of original American melodies. I have composed only in (their) spirit".

That much will be evident as you listen. According to some commentators, you will be responding to Dvorak's Czech-hued setting of Longfellow's "Song of Hiawatha" and perhaps the words of "Goin' Home", which were later set to Dvorak's original melody.

The Vienna Philharmonic Orchestra is no stranger to the "New World" and, under Lorin Maazel, the orchestra produces a range of sound from the gently lyrical to thrusting and dynamic, especially in the high violins and the brass. It is a well-played, clean, dynamic sound but it won't be everybody's favourite performance.

To hifi buffs, it will tend to sound somewhat "mildly", probably because of the acoustics, the mic placement and the emphasis on strings and brass. By comparisons, Telarc's Slatkin/St Louis SO version, which I still have on digitally-sourced LP, is a much fuller, traditionally blanded orchestral sound, with a lot more weight in the bass end.

But it doesn't have the thrusting brilliance of the DG version, or the bonus of the popular "Carnival Overture" by way of a fill.

With the choice of commendable versions likely to be available, my advice on this one would be to listen around — a few minutes of the opening Adagio may be sufficient — and select the one which best suits your taste. (W.N.W.)



## TRUMPET VIRTUOSO

**The Classic Trumpet Concerti of Haydn and Hummel.** Gerard Schwarz, soloist and conductor with the Y Chamber Symphony of New York. Compact disc, Delos D/CD 3001. [From PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4022.]

This is an interesting recording and one well worth keeping in mind for your compact disc collection. Joseph Haydn's Trumpet Concerto in E flat Major (14' 58") is considered by many to be the composer's most notable composition in the concerto genre. It is paired here with another trumpet classic by his protegee Johann Nepomuk Hummel, the Trumpet Concerto in E Major (18' 00").

Both were composed primarily for a renowned Viennese court trumpeter, Anton Weidinger who, around 1800, had been experimenting with finger-pad trumpets — rather like modern woodwind instruments — in an effort to extend their capacity to play diatonic and chromatic melodies. But Haydn, at least, was disappointed at what he heard, feeling that Weidinger was trying to play his finest concerto on a still-limited instrument. Unfortunately, Haydn did not live long enough to hear Bluehmel's "valve" trumpet, which made its appearance in 1813.

One can only speculate how he would have reacted had he been able to hear a performance as available on this recording, featuring one of the world's leading trumpeters, playing a superb modern instrument and backed by a top-



ranking chamber orchestra.

For Gerard Schwarz, the recording probably represented something of a high point in his career. A member of the American Brass Quintet at age 18, and co-principal trumpeter of the New York Philharmonic Orchestra, he received a Grammy nomination in 1980 for his performance of the Classic Trumpet Concerti of Haydn/Hummel. But he was already moving away from the role of featured soloist to that of conductor, and his virtuoso trumpet has since been laid aside.

But what a superb performance it is. In the dual role of conductor and soloist, he wins from the instrument an enormous dynamic range, yet without any suggestion of unmusical blare. His legato passages are incredibly smooth and, at the other extreme, his technique is quite dazzling. As a trumpeter, Schwarz may have had peers, but I doubt that you will hear better.

The recording is interesting in another way, in that it was the first ever to reach me, in digitally-sourced LP form, on the Delos label. Paralleling the philosophy of Telarc, Delos opted for a three-microphone set-up using, in this case, special B&K models which offered 30dB of headroom above the usual maximum of 130dB SPL. This, along with battery-powered preamplification and a Soundstream digital master recorder.

Delos certainly got it right because, on this new compact disc, manufactured in Japan by Sanyo, you get beautifully balanced sound, free from any suggestion of noise, overload or distortion.

Let me simply repeat what I said in my original review, back in April 1980: don't pass this over because you don't happen to be a classical music buff. This is highly listenable music, so performed and so recorded that you'll want to hear it over and over again, and play it to your friends. If this sounds like an enthusiastic review ... it is! (W.N.W.)

## MOUNTAIN, PICTURES

**Moussorgsky: Pictures at an Exhibition; Night on Bald Mountain.** The Cleveland Orchestra conducted by Lorin Maazel. Compact disc, Telarc DC-80042. [From PC Stereo Pty Ltd, PO Box 272, Mt Gravatt, Qld 4022. Phone (02) 343 1612].

Recorded originally in 1978, this Cleveland/Maazel performance of "The Pictures" has been reviewed in many places and accepted as a typical Telarc audiophile tour-de-force. But, while viewed with "appropriate" reserve in the somewhat conservative analog era, the original Soundstream digital master

recording really comes into its own on compact disc. The orchestral complexities and the massive drum bass which could over-stress even some much-loved phono cartridges present no problem to the laser beam in a CD player.

The recording opens with Moussorgsky's "Night on Bald Mountain" (10' 24"), seen by some critics as a "hideous" work and still disliked by others for similar reasons. It depicts, under the cover of night, the subterranean din of unearthly voices, spirits of darkness, the black god and the black mass, and the witches' sabbath. But all this physical and spiritual darkness is dispelled by dawn and the sound of a distant church bell, which ushers in worship of a quite different kind.

Moussorgsky's original score, completed in 1867, was subsequently revised and orchestrated by Rimsky-Korsakov, who also added one of the composer's own songs "Reverie of a Young Peasant" by way of a fitting coda.

The now-popular tone poem is well played and, technically, provides a foretaste of what is to follow.

"Pictures at an Exhibition" (30' 16") was composed by a resentful Moussorgsky as homage to an artist friend Victor Hartmann who, he felt, had died while other less worthy creatures had inexplicably continued to live. He imagines himself at an exhibition of Hartmann's drawings, reacting to each, as he moves along:

Gnomus — a misshapen dwarf; il Vecchio Castello — a troubadour at an old castle; Tuileries — with quarrelling children; Gydlo — an ox cart and singing wagoner; Ballet of the Unhatched Chicks; Samuel Goldenberg and Schmuyle; the Market Place at Limoges — chattering women; the Catacombs; the Hut of Baba Yaga; the Great Gate of Kiev.

Originally composed for solo piano in 1874, "The Pictures" attracted little attention until after 1922 when, on a commission from Serge Koussevitsky, it was transcribed for orchestra by Maurice Ravel. Under his genius, the pictures of Hartmann and the inspiration of Moussorgsky was revealed in full orchestral colour in a work that has since won enduring popularity on the concert platform.

Lorin Maazel and the Cleveland Orchestra give a fine account of it here in a recording that is notable for its clean sound, its open texture even in the presence of so much complexity, and its considerable dynamic range.

If you're an audiophile, there's only one way to describe The Great Gate of Kiev: "Phew!" (W.N.W.)

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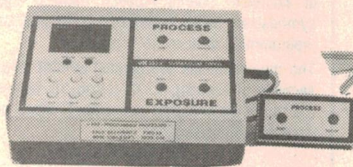


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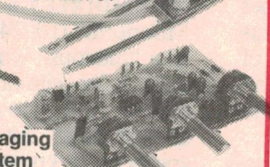


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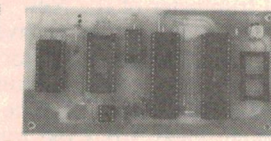
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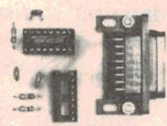


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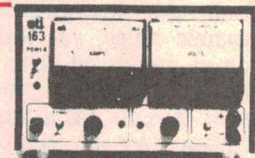


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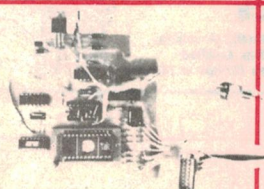


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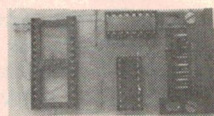
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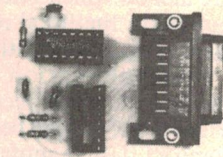
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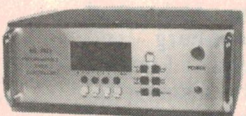


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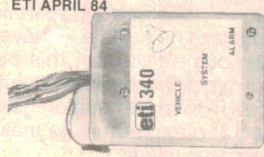


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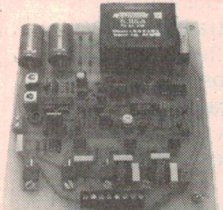
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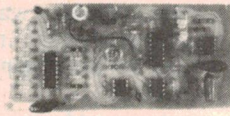
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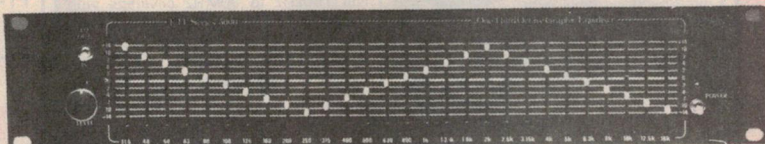
### SPECIFICATIONS:

INPUTS  
Line 22 db/18K x 12  
Phono 52 db/50K STEREO x 2 (2mv) at 1kHz  
Effect Return (Aux) 20 db/50K x 1  
OUTPUTS  
Level Impedance L & R 0 db/2K  
Effect Send 0 db/2K F/B Out 0 db/2K  
Head phone Stereo +10 db/600 (100 - 1K)  
EQUALISATION  
Channel  
Bass  $\pm 15$ db  
Treble  $\pm 15$ db  
Master  
Bass  $\pm 12$ db  
Treble  $\pm 10$ db  
Middle  $\pm 12$ db

### FADER & CONTROLLERS

12 channel fader: Slide, 60mm; LOG 25%  
2 Master fader: Slide, 60mm; LOG 15%  
12 F/B Volume: 300; LIN  
12 Effect Send: 300; LIN  
1 Effect Return: 300; LOG 15%  
2 Phono: 300; LOG 15%  
1 Head Phone: 300; LOG 15%  
S/N: 58dB  
FREQUENCY RESPONSE: 20-20 kHz  
TOTAL HARMONIC DISTORTION: Less than 0.1%  
METER: 2 illuminated VU Meters 0db = 0.775V  
PEAK INDICATOR: 12 LED Peak Indicators  
VOLTAGE: 240 VAC 50Hz  
POWER CONSUMPTION: 7.2 watts  
DIMENSIONS: 620 (W) x 386 (D) x 108 (H) mm (supplied complete with carrying case)

## THIRD OCTAVE GRAPHIC EQUALIZER



### SPECIFICATIONS E.T.I. Dec. 1982

Bands: 28 Bands from 31.5 Hz to 16 kHz  
Noise: < 0.008 mV, sliders at 0, gain at 0 (-102 dB).  
20 kHz bandwidth  
Distortion: 0.007% at 300 mV signal, sliders at 0, gain at 0; max. 0.01%, sliders at minimum.  
Frequency Response: 12 Hz-105 kHz, +0, -1 dB, all controls flat.  
Boost & Cut: 14 dB

\$195.00 1 Unit  
\$379.00 2 Units

## SERIES 4000 SPEAKERS.

- 8 speakers with crossovers ..... \$499
- Speaker boxes (assembled with grill and speaker cutout) ... \$299
- Crossover kits ..... \$199
- Complete kit of parts (speakers, crossovers, screws, inner-band boxes) ..... \$799
- Assembled, tested, ready to be hooked up to your system ... \$849



WE BELIEVE THAT WE ARE NOW THE ONLY ONES TO SUPPLY COMPLETE SPEAKER KITS ASSEMBLED AND TESTED FOR THOSE WHO HAVEN'T GOT TIME \$849 EX STOCK.

PLEASE WRITE FOR CONSTRUCTION NOTES, THESE COMPLIMENT THE SERIES 5000 AMP RANGE AND ADD THE FINAL TOUCH.

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Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436  
Mail orders to P.O. Box 235 Northcote 3070 Vic.  
Minimum P & P \$3.00. Errors & omissions excepted.

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**RITRONICS WHOLESALE**  
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923  
Telex AA 38897



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EXCELLENCE ...

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BUY NOW AND  
GET YOUR BONUS!

All mode  
computer aided  
HF Transceiver ...

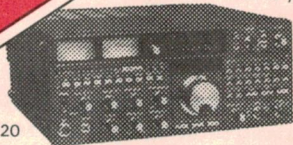
## FT 980

Our top-of-the-line Yaesu: all mode,  
all band HF with general coverage receive.  
It even uses an 8-bit micro - and can be  
linked to your personal computer!

**\$1995**

**BONUS!**

MD1B8 Desk  
mic Save \$99  
Cat C-1114



Cat D-2920

## Go-anywhere UHF FT 708 H/Held

10 memories, standard repeater  
splits and 1W output on 70cm:  
that's the FT708. Memory or  
band scanning, complete  
with Ni Cad battery and  
charger.

**\$399**



**BONUS**

Free YM-24A  
Speaker/  
Microphone  
Save \$39  
Cat C-1111



Cat D-2930

## FT 208R

Or try this one for two metres: the  
superb FT208. Also has 10 mem-  
ories, standard +/-1600kHz  
splits built in and comes  
with Ni cad battery  
& charger.

**ONLY \$359**



**BONUS**

Free YM-24A  
Speaker/Mic  
Save \$39  
Cat C-111



Cat D-2889

3-way, all mode, 2 metre

## FT 290R



The most flexible 2m  
rig around: portable with  
internal batteries, mobile or  
base with external 12V & antenna  
... PLUS it's all mode. Great for packet  
radio, too! Cat D-2885

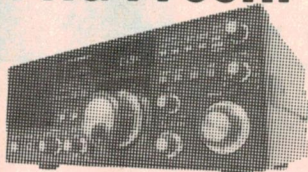
**\$429**



**BONUS** Free set of 8 'C'  
size Ni Cads... Save \$49.80  
Cat S-3301

Communications at its best

## FRG 7700HF



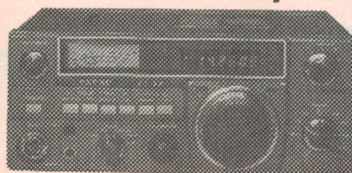
Full 150kHz to 30MHz coverage with  
superb bandspread: a receiver you'll be  
proud to own and use. 240V operated,  
includes 12V conversion kit. Cat D-2840

**ONLY \$579**



**BONUS** Free Antenna  
Coupler Save \$95  
Cat D-2843

## The Thrifty HF Transceiver



## FT 77S

Small size - but big in features: that's  
the superb FT77S. It uses the latest  
CAD/CAM techniques with nominal  
10W output on all HF bands - WARC  
included!

The ideal set for the Novice. And if  
you're on a budget, you cannot go  
past the FT77S.

13.5V operated - so it's just as much  
at home mobile as it is back home.  
And if you want that extra oomph, go  
for the superb FT77. 100 watts  
output on all HF bands ... and it's a  
massive \$100 off last year's price!

FT-77S: Cat D-2914 **\$599**

Or High Power Version: **\$699**

FT-77: Cat D-2915 **\$799**



**BONUS:** Buy either set  
this month and get a FREE

MH-1B8 Scanning  
Cat C-1116 Microphone Save \$35

## BOOKS!

### 1984 US Amateur Callbook

All W & K calls with QTH. A must for the  
DXer! Cat B-2184

### 1984 Foreign Amateur Callbook

All calls except W & K - includes good ol'  
VK! Cat B-2284

**\$29<sup>95</sup>**  
ea.

## UHF SWR/Power Meter!

No more guesswork at UHF! Quality UHF  
meter made by Osborn covers all of  
70cm Amateur band plus CB band.  
Essential for the  
Z call!



Cat Q-1342

**\$99<sup>00</sup>**

## FRB 757 Relay Switching Box

You asked for it! Allows FT757 to be used  
with variety of linears, etc. And at this low  
price it's a steal!  
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**\$15<sup>95</sup>**

## FAS-1-4R Remote Antenna Selector

Use with the FC-757 Auto Antenna Tuner  
to remotely select one of four antennas  
right at the top of the tower - with only one  
feedline and one control line station.  
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**\$99<sup>50</sup>**

## Want to use your FT 757 in the shack?



Cat D-2941

**\$299**

Quality switch-mode supply plugs straight  
into FT757 - very thin design fits under-  
neath rig. Suitable for 50% duty cycle.

## Need a general purpose rig supply?

More than just a supply! 20 amps of  
regulated muscle, PLUS an external speaker  
for ultra-clear QSO's. Suits most types of  
nominal 12V (13.8V) powered transceivers,  
plus directly into FT77/S.

Cat D-2916 **FP700 \$225**

## Look Mum! No hands! YH-1 Headset Mic.

Now you can go mobile with safety - leaving  
your hands free for driving. Lightweight &  
comfy single-ear phone plus boom mic.  
Suits most types of transceivers. Use  
appropriate switch box below for your rig.  
Cat C-4195

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Spring loaded PTT and lock on transmit.  
Shirt pocket clip included, TX light.

SB-1 Suits FT208, FT708 & other mini  
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You'll find a licensed amateur at each Shack.

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# DICK SMITH ELECTRONICS



See page 30 for address details





# Letters to the editor

## Unemployment: wisdom must prevail

I am a Small Business man who has worked for the most part of 15 years at the rate of 60 hours per week. I was staggered to read the NSW Minister for Transport, Mr Unsworth's comment on information technology in Sydney. To quote:

"When I see young people at the beach surfing from dawn to dusk, I do not see them as being dole bludgers. I think they are very smart Australians who know how to while away the idle hours society has doled out, work being deprived to them. If we live in a country that cannot provide employment for all, we have to look at how we cater for the needs of those not among those chosen to take up positions in the workforce."

650,000 businesses in Australia like mine employ less than 10 people. Small businesses earn more profits and pay more taxes than the whole of the big business sector.

If each small company could employ someone at a rate similar to the dole without breaking the law, you would quickly see the unemployment fall. Yes, they would be doing menial tasks; sweeping floors, cleaning cars or process work, but at least they would be making a contribution to wealth generation instead of revenue debilitation.

Of course, why should they work at the same rate if our society is prepared to pay them to do nothing.

It's an unpleasant decision for our politicians but surely wisdom must prevail.

Tony Cox, Managing Director  
Adfoam Industries Pty Ltd,  
Brookvale, NSW.

## Praise for Neville Williams

As an avid reader of *Radio & Hobbies*, *Radio Television and Hobbies* and *Electronics Australia* for the past 25 years, I would like to take this opportunity to pass on my sincere thanks to Neville Williams for his outstanding contribution to the magazine and to the advancement of electronic knowledge in the community in general, even if he has been "paid to work at his hobby". I too can well remember the days of octal

sockets, aluminium chassis, 20% resistors, ultra linear output transformers, Radiotron Designer Handbooks and Wharfedale 15-inch speakers in nine cubic foot brick corner enclosures.

I must say I have always enjoyed Mr Williams' no-nonsense, straight down the middle literary style in all facets of the magazine, whether it be on technical matters or record reviews. His recent series of articles on Compact Disc have been especially informative and educational. I am sure I speak for all readers of the magazine, both young and old, in congratulating him on a job well done.

Peter Watson,  
North Balwyn, Vic.

## Floppy disk standards

Thank you for reviewing our Chinon 3-inch floppy disk drive in the April issue of *Electronics Australia*. However, the point concerning standards should not go unanswered.

There is only one standard for the 3-inch drive. Both media and drive characteristics were defined by Hitachi, Maxell and Matsushita and subsequently supported by Toshiba, Sankyo, Canon Janome and now Chinon.

The adoption of the Sony 3½-inch drive by Hewlett-Packard, Apple and ACT-Apricot does not indicate standards leadership although it may encourage

media second sourcing. Verbatim have announced their intentions in this area but no product is yet available.

The H-P drive is a Sony 3½-inch 600rpm, 70-track single side unit capable of storing 250 Kbyte unformatted.

Apple has a variable speed drive capable of storing 400 Kbyte and the Apricot uses a 300rpm 80-track format.

Drive second sourcing is by Tandon and Shugart although, contrary to MIC recommendations, neither drive is compatible with Sony nor with each other. Chinon is also second sourcing the Sony drive.

Tabor's 3¼ drive is now second sourced by Seagate and MPI. It is the only sub 100mm drive which has an effective double sided capability and the soft jacket media is manufactured by conventional packaging techniques. Disk manufacturers include Dysan, 3M and Brown Disk, with others due to follow.

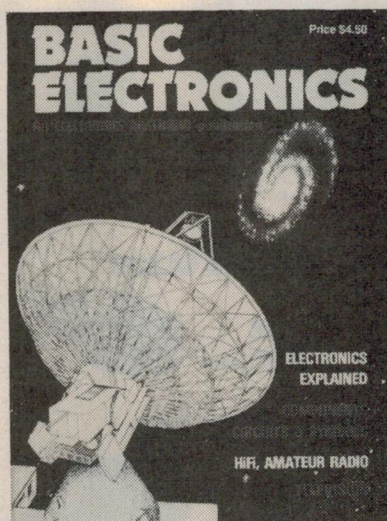
Daneva is not going to bet its future on one standard. We will be sourcing all three in the knowledge that each has benefits over its rivals and will develop its own niche.

Stuart Wright, Managing Director,  
Daneva Australia Pty Ltd,  
Sandringham, Vic.

## Parts wanted

I need some assistance and was hoping that one of your readers may be able to help. I have an old Mullard Dual Wave Model 61A valve radio receiver and would like to know the approximate date of manufacture, the years distributed and any other relevant information. My unit has a broken dial glass and I would be grateful for assistance in locating a suitable replacement.

A. Taylor,  
71 Andrew Rd, Valentine, NSW.



Basic Electronics is almost certainly the most widely used manual on electronic fundamentals in Australia. It is used by radio clubs, in secondary schools and colleges, and in WIA youth radio clubs. It begins with the electron, introduces and explains components and circuit concepts and progresses through radio, audio techniques, servicing test instruments, television, etc. If you've always wanted to become involved in electronics, but have been scared off by the mysteries involved, let Basic Electronics explain them to you.

Available from: Electronics Australia, 57 Regent Street, Chippendale, Sydney 2008. **PRICE \$4.50**, OR by Mail Order: Send Money Order or Cheque to Electronics Australia, PO Box 163, Chippendale, NSW 2008. **PRICE \$5.40**.



# FOR 30<sup>c</sup> POST AN ORDER TO ONE OF ALTRONICS COMPETITORS

— naturally you won't have a clue as to whether they've got the items you need available. And of course, be prepared to wait, wait, patiently wait sometimes for weeks!  
**Why waste your valuable cash? Altronics staff are waiting for your call now (up to 6pm eastern standard time).**

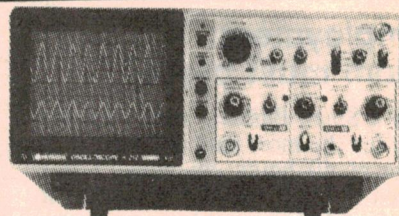
## NEW HITACHI F SERIES SQUARE SCREEN DUAL BEAM CRO

V-212 DC to 20 MHz, 1 mV/div, DUAL-TRACE

We are proud to include Hitachi's latest oscilloscope in our range of test equipment.

It features: • Thin, light and compact design (310W x 130H x 370D mm, 6 kg) • Large 6 inch rectangular, internal graticule CRT • Vertical

mode triggering selection to provide stable triggering of each channel • High accuracy  $\pm 3\%$  • High sensitivity 1mV/div • Stable, low drift design • TV sync separation circuit built-in • Convenient X-Y mode for phase difference measurements • Tilting bail supplied.



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Q0152..... **\$699.00**

## MICROWAVE OVEN LEAK DETECTOR



### ETI PROJECT

Completely passive project receives microwaves via an antenna which develops a voltage across a detector diode driving the meter. Monitor your microwave oven with this easy to build kit. All components mount on single PCB, including the meter. Genuine Hewlett Packard Hot Carrier Diode supplied.

K1724..... (still only) **\$14.50**

## THE DAZZLING MUSICOLOR IV PROJECT



Combination Colour Organ and Light Chaser. Four channel colour organ, internal micro-phone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

K5800..... **\$89.50**

## MULTIPROM INTERFACE

44K OF PROGRAM STORAGE



A sensational new kit for the MICROBEE, requires no modification to the computer except for the fitting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44K of eeprom storage — acts like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

The Altronics Kit comes complete in every way

- \* Full set of IC sockets.
- \* Double sided, plated through board.
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- \* Fully documented.
- \* Cassette monitor included (plus sourcefile).

THE MICROBEE KIT OF 1985

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200mm (8 in.). 10 Watts Max. power input. Public Address, Background Music. Ideal Hi Fi extension speaker. Includes transformer holes at 51mm. Over 30,000 sold in Australia! Mounting holes 140 x 140mm.

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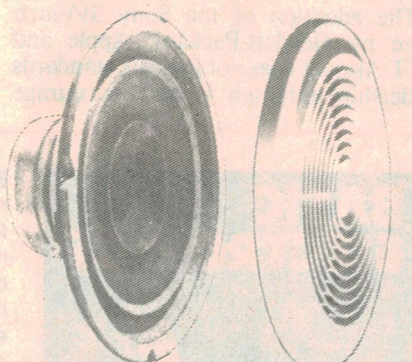
**INCREDIBLE VALUE BULK PACKS**

ALL COMPUTER SELECTED

SUPER PRICE

**\$5 each**

R3501..... **25W Resistor Pack**  
 Av. contents 300..... **\$12 Value**



## FUSE HOLDER M205

20 x 5mm Fuse

S5990..... **90c**  
 10 UP..... **80c each**

## FUSE HOLDER 3AG

32 x 6.3mm Fuse

S6000..... **95c**  
 10 Up..... **85c each**



## MINI SPEAKER 57mm

**200 MW 8 OHM**  
 Large Ferrite Magnet. Ideal replacement speaker. Great for hobby projects.

C 0610... **\$1.95**  
 10 Up... **\$1.50**

## MINI SPEAKER 82.5mm (3 1/4 in.)

**3 watt 8 OHM**  
 Mounting Holes at 71mm centres.

C 0612... **\$4.75**  
 10 Up... **\$4.25**

## 165 mm (6 1/2 in.)

Dual Z 4/8 OHM  
**3 Watt RMS**  
 Mounting holes at 112mm.

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 10 Up... **\$7.25**



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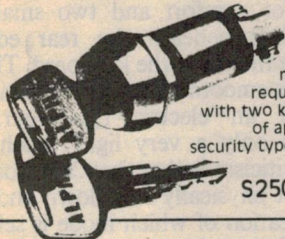
Our superb instrument cases will give your projects the professional appearance they deserve.

	WAS	NOW	10 +
H0480	\$13.50	\$11.50	\$ 9.50
H0482	\$17.50	\$15.00	\$12.25

OEM's — Manufacturers — Bulk Users. Your product will look like it's straight out of "Hewlett Packard's" factory with these brilliant low cost cases. Contact our Wholesale Department for Bulk Prices.

## KEY OPERATED SWITCH

HALF PRICE! BE QUICK

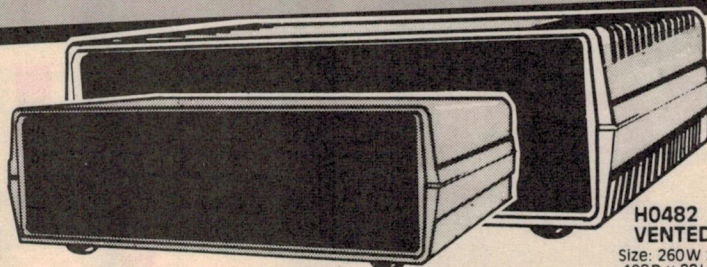


19.5mm mounting hole required. Supplied with two keys. Hundreds of applications for security type applications.

\$2500 **\$3.50**

**H0480**  
Size: 200W x 160D x 70H

- \* Internal mounting posts enable a wide combination of PCB's, Transformers, etc. to be accommodated (screws supplied).
- \* Removable front and rear panels. Attractive textured finish one side and plain the reverse side. (Enables direct engraving, silk screen printing etc. to plain side.)



**H0482 VENTED**  
Size: 260W x 190D x 80H

- \* Top and bottom split apart for ease of construction or service. Integral feet included.
- \* Great for test instrument and other high grade projects.
- \* PCB guide rails provided internally allow vertical PCB positioning to several locations.

## LOGIC PROBE

**Q1272**  
WAS \$29.50



**ONLY \$19.50**

- \* Directly powered from circuit under test (5V)
- \* Tested to 12.6 MHz \* DTL/TTL — CMOS Threshold selector \* Circuit loading 30uA approx. \* High-Low — pulse or memory led indication. Impulse

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*Electronics Australia reviews the*

# Hyperion Personal Computer

**For business and professional use**

*The Hyperion personal computer from the Canadian company Bytec is an IBM-compatible "transportable" with some useful enhancements. It features excellent graphics capabilities and a wide range of software for business and professional use.*

by PETER VERNON

The most immediately striking aspect of the Hyperion computer is the design, a stylish combination of built-in screen and dual disk drives with a low-profile detached keyboard which is a delight to use. Forethought is evident in all aspects,

from the recessed front panel controls for the video display to the quality of the internal construction. The carrying handle moulded into the top of the case and the sloping shelf at the bottom which tilts the main unit for convenient

The detached keyboard features 74 keys laid out in standard qwerty pattern.

viewing, while also providing storage for the keyboard, are also good features.

With dimensions of 455 x 263 x 215mm (W x D x H) for the system unit and a weight of around 9kg, the Hyperion is "luggable" rather than portable. The attraction however is that the computer can be carried fairly easily from one workplace to another while providing everything necessary for serious business or professional use.

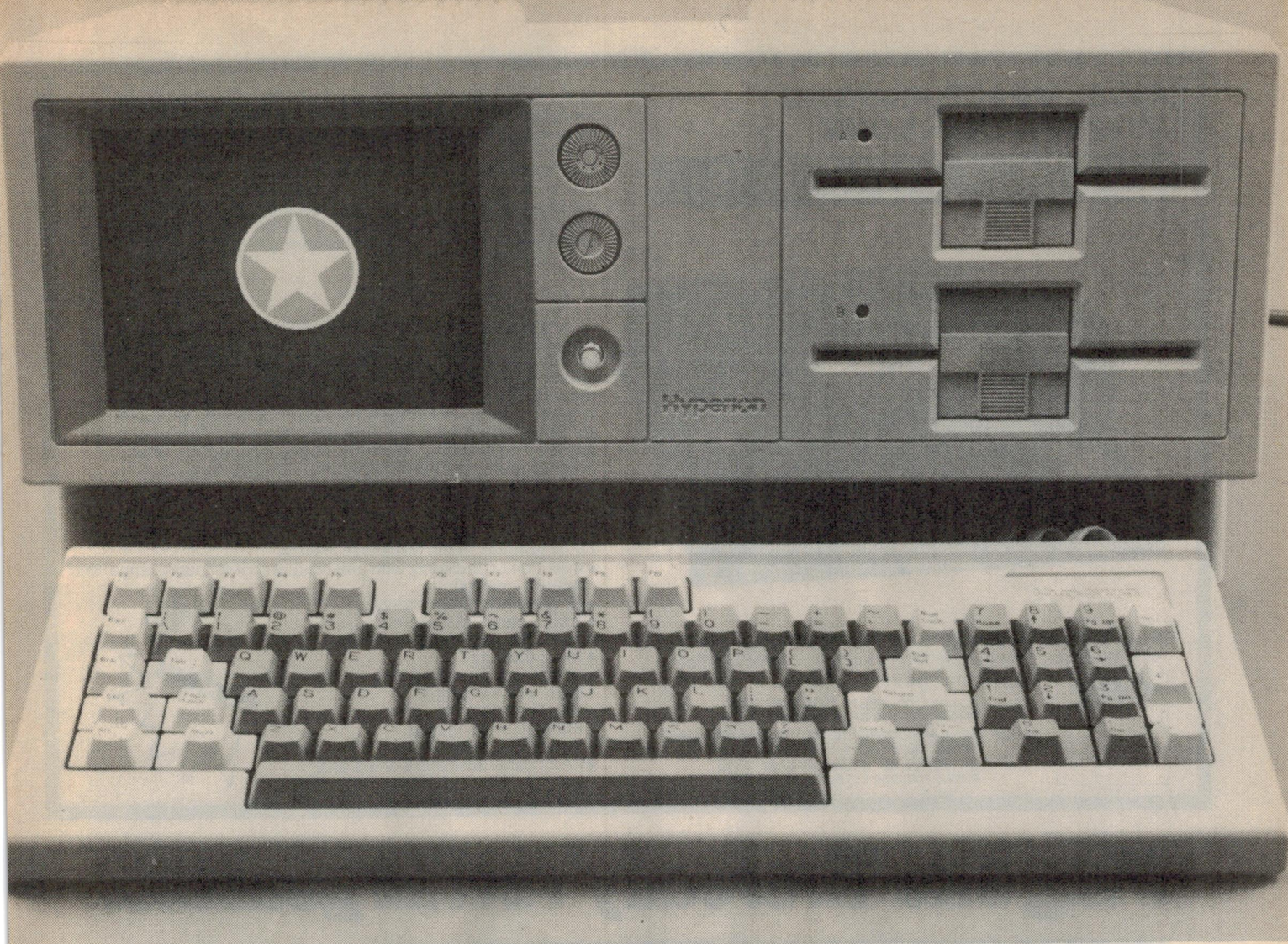
The keyboard has 74 alphanumeric keys laid out in a standard qwerty pattern and including a 14-key numeric pad with cursor control keys. Standard keys are in non-glare grey with control and special function keys highlighted in white. Ten "soft keys" above the standard keys can be programmed to allow single key entry of commonly used commands in MS-DOS, Basic or applications programs such as Spellbinder or Lotus 1-2-3.

Overall dimensions of the keyboard are 455 x 215 x 15mm (W x D x H), with the typing surface arranged in a concave plane for comfort and two small flip-down legs beneath the rear edge to increase the tilt of the keyboard. The key action is smooth and positive, similar to that of an electric typewriter, and requires only a very light touch. One small criticism is that the Caps Lock key does not physically lock down and gives no indication of which mode is selected. Most of the software packages designed for the Hyperion indicate the status of Caps Lock on the screen, but some programs do not.

A 17cm (diagonal) video display screen is built-in on the left side of the Hyperion front panel. The standard text display is 80 characters by 25 lines, with the bottom line dedicated to display of labels for the soft keys, although the labels can be turned off if desired. Text is displayed in amber on a non-glare background and is sharp and easily legible at comfortable viewing distances, although of course







**The Hyperion computer features a built-in video display, dual disk drives and a low-profile detached keyboard.**

individual letters are smaller than those displayed on larger video monitors. An automatic "screen saver" feature blanks the video display if the computer receives no input for a three minute period.

An unusual feature of the Hyperion is that the screen can emulate either the IBM monochrome or colour displays under software control. In the "colour emulation" mode, different intensities of amber are used to simulate colour graphics. This means that software designed for the IBM PC's colour graphics adapter board will also run on the Hyperion computer, in contrast to the problems experienced with the same software on some other "compatibles".

Text can be displayed with either 80 or 40 characters per line with character attributes (underline, blinking, intensified, reverse and sub and superscripts) interpreted either according to IBM PC standard or an enhanced Hyperion standard. Five "pages" are available for text so that it is possible, for example, to write on one page while displaying another. This feature eases

the task of programmers in providing "help" screens etc and hence also indirectly benefits users.

Graphics capabilities are also extensive, with two medium and two high resolution modes available. One set of these provides 320 x 200 and 640 x 200 pixel resolution and is compatible with IBM PC software, while the other set maintains the same horizontal resolution but increases vertical resolution to 250 pixels. Both medium resolution modes allow the use of four levels of intensity to produce different shades on the screen.

Finally, for those users who require a larger screen for demonstration purposes or whatever, a connector on the rear panel of the main unit provides a standard composite video signal output.

Also at the rear of the main unit are connectors for 240VAC power, a phone line connection, telephone handset (of which more later) and an acoustic coupler, parallel and serial printer ports and bus expansion port. All these connectors are labelled with unob-

trusive symbols and the printer and expansion ports are provided with tapped stand-offs to secure the appropriate cables in place.

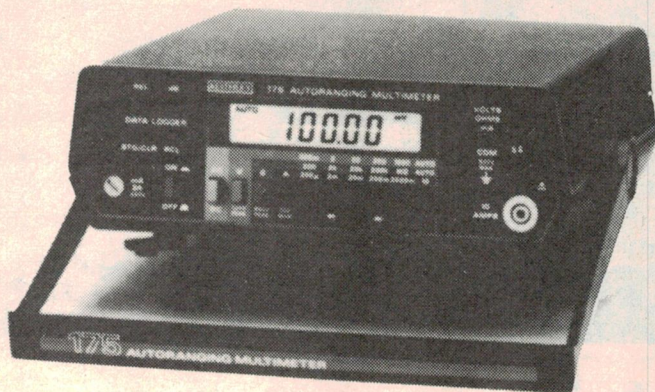
Power for the Hyperion is controlled by a large illuminated pushbutton on the front panel, just next to the screen. When first switched on with a diskette in place in drive A the Hyperion performs a diagnostic self-test (for about 30 seconds) and then proceeds to load commonly used MS-DOS command files from the disk into an area of RAM set aside as a disk emulator (called Drive C). The size of this area is set to 90K by default and the copying process takes only a few seconds. From this point common operating system commands can be used without a disk access, considerably speeding up the operation of the computer.

Other programs can also use the disk emulator, again providing a significant increase in speed, while the MODE command allows the user to vary the size of the disk emulator area (and also to set screen options and printer



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The new Model 175 Autoranging Bench Digital Multimeter, from Keithley Instruments, Inc., combines the measurement capabilities of much higher-priced system DMMs with several new features to extend its utility, yet retain simplicity of use. Ideal for use as a bench meter in production or lab work, this 4-1/2 digit autoranging DMM also has a field-installable battery option, making it fully portable. Fast autoranging (up to 200ms per range change on DCV) enables the user to concentrate on getting the reading without worrying about choosing the appropriate range.

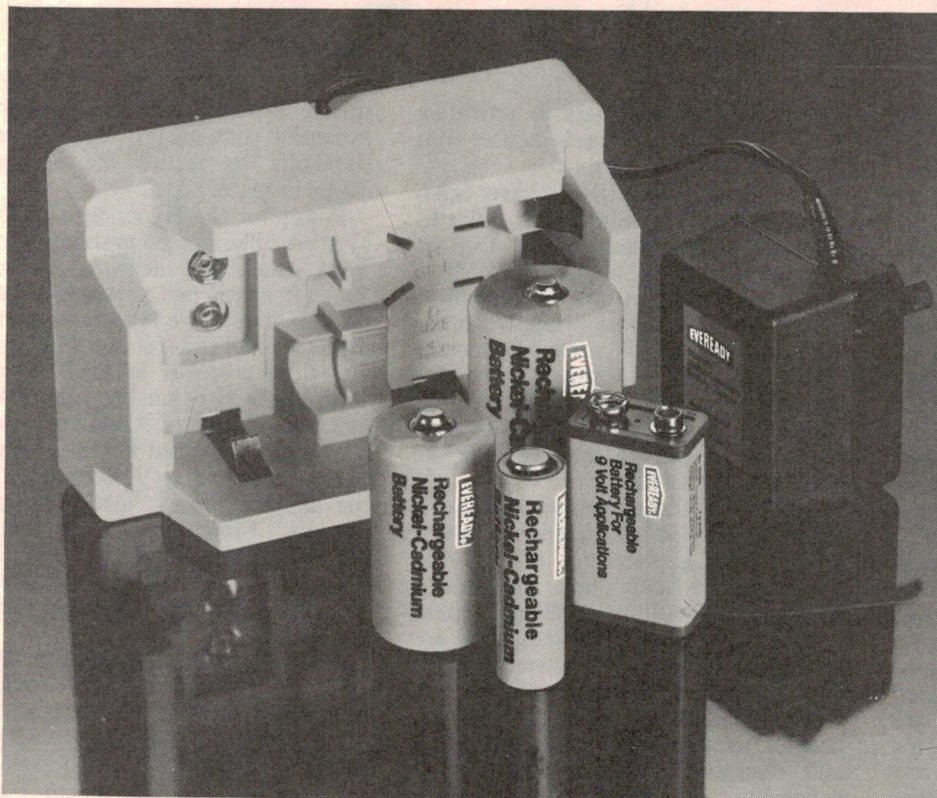
The Model 175 features digital calibration for reduced cost of ownership, as many users can now calibrate the meter in-house. With the Model 1753 IEEE-488 (GPIB) option, the 175 is the lowest-priced IEEE-interface DMM available. Model 175's 100-point data logger monitors drifts, determines rates of change, and collects response curve data without a printer, output cables, or complicated hook-ups. The data logger has six different store rates from one reading/400ms to one reading/hour, and data recall is "push-button" easy.

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# Hyperion Personal Computer

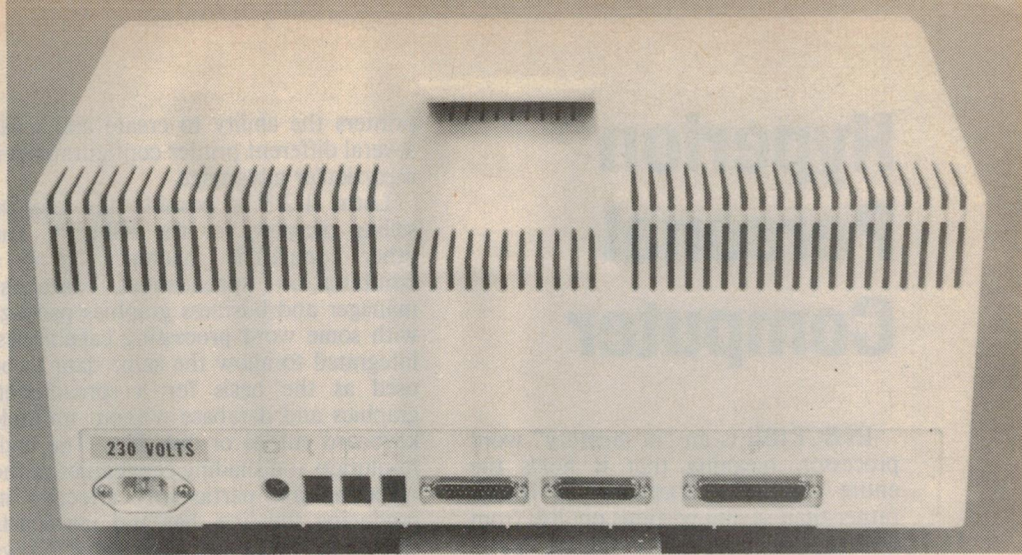
configuration). The contents of drive C are not permanent however and are lost when the Hyperion is turned off. It is intended for temporary storage of frequently used commands, not important data files or programs, but is a very nice feature nonetheless.

## Hyperion hardware

The Hyperion is based on the Intel 8088 8/16-bit microprocessor running at a 4.77MHz clock speed and there is provision for the installation of the 8087 numeric co-processor to speed up intensive mathematical operations. Memory size is 256K, with an additional 20K of static RAM used for the screen memory and 8K of ROM for the diagnostic and initialisation programs. A battery-powered clock and calendar provides ready access to the time and date, displayed on the screen with the soft key labels by the operating system or called up with TIME and DATE commands from other programs.

Mass storage is provided by two built-in Remex 13cm minifloppy disk drives with convenient "push to open, push to close" door latches. With no disks in the drives the read/write heads are locked apart to eliminate the possibility of damage caused by sudden bumps, an important consideration for a transportable machine. The disk drives are double-sided, double density types, each providing 320K bytes of storage.

Hyperion departs from IBM's concept of an "open system" by having no



The rear panel features parallel and serial printer ports, a bus expansion port and connectors for an acoustic coupler, telephone line and handset.

internal general-purpose expansion slots, but considering the likely applications of the machine and the extensive features already provided, this is not likely to be a problem. For those who insist upon using special purpose boards a separate expansion box will be available shortly, containing seven IBM-compatible hardware slots and a hard disk drive.

One expansion option is particularly worth mentioning. The previous reference to a telephone handset connection indicates the Hyperion's potential as a communications terminal. Indeed, Hyperions intended for the north American market come with a built-in modem. In Australia this add-on modem is awaiting approval by Telecom, but the Hyperion hardware and software remains ideally suited for use as a communications terminal.

The three communications connectors are American style RJ-11 telephone sockets, but suitable adapter cables will be available from the Australian distributors of the machine. The Hyperion with built-in modem is intended to be connected between a

telephone handset and a telephone wall socket (Telecom permitting) with the acoustic coupler output available when direct connection is not possible.

The IN:TOUCH software package supplied by Bytec can control the 300 baud modem, automatically dial the phone, maintain directories of telephone numbers and control the volume of the computer's internal speaker to allow voice calls to be monitored. The communications interface can be configured for most popular data transmission protocols and the program also includes a "Learn" mode which will remember the log-on sequence for a particular telephone number. Once the number is on file a single touch of a soft key will dial and another key will transmit the correct log-on sequence for a particular database.

It is to be hoped that the Hyperion can meet Telecom's standards for connection to the public telephone network so that Australian users can have the benefit of the advanced features provided by the communications hardware/software combination.

## Operating system and applications software

The operating system of the Hyperion is MS-DOS 1.1 with enhancements. It includes the standard routines such as CHKDSK, COM1, DEBUG and the EDLIN text editor but also incorporates extensions to the MODE command and routines for defining the programmable soft keys. An EXPLAIN command which provides extensive HELP files on all aspects of system operation, called up with one or two key presses, has also been added.

Application software supplied for the Hyperion includes the IN:SCRIBE word processing package from Bytec, the Multiplan spreadsheet program, Lotus 1-2-3, the Aladin database management system, Microsoft's 8086 Macro Assembler and Microsoft GWBASIC.

## BasicA statements and functions

ABS, ASC, ATN, AUTO, BEEP, BLOAD, BSAVE, CALL, CDBL, CHAIN, CHR\$, CINT, CIRCLE, CLEAR, CLOSE, CLS, COLOR(A), COLOR(G), COM(n), COMMON, CONT, COS, CSNG, CSRLIN, CVI, CVS, CVD, DATA, DATE\$, DEF FN, DEF SEG, DEF USR, DEFINT, DELETE, DIM, DRAW, EDIT, END, EOF, ERASE, ERR, ERL, ERROR, EXP, FIELD, FILES, FIX, FOR...NEXT, FRE, GET(A), GET(G), GOSUB, GOTO, HEX\$, IF...ELSE, IF...GOTO, IF...THEN, INKEY\$, INP, INPUT, INPUT#, INSTR, INT, KEY, KILL, LEFT\$, LEN, LET, LINE, LINE INPUT, LINE INPUT#, LIST, LLIST, LOAD, LOC, LOCATE, LOF, LOG, LPOS, LPRINT, LPRINT USING, LSET&RSET, MERGE, MID\$, MKI\$, MKS\$, MKD\$, NAME, NEW, OCT\$, ON COM(n), ON ERROR GOTO, ON KEY, ON...GOSUB, ON...GOTO, OPEN, OPEN COM1:, OPTION BASE, OUT, PAINT, PEEK, PLAY, POINT, POKE, POS, PRESET, PRINT, PRINT# USING, PRINT USING, PRINT#, PSET, PUT(A), PUT(G), RANDOMIZE, READ, REM, RENUM, RESTORE, RESUME, RETURN, RIGHT\$, RND, RUN, SAVE, SCREEN, SGN, SIN, SOUND, SPACES, SPC, SQR, STOP, STR\$, STRINGS, SWAP, SYSTEM, TAB, TAN, TIME\$, TRON/TROFF, USR, VAL, VARPTR\$, WAIT, WHILE...WEND, WIDTH, WRITE, WRITE#



# Hyperion Personal Computer

IN:SCRIBE is an "in memory" word processor, meaning that it holds the entire text of a document in RAM, rather than saving portions on disk from time to time. As such it avoids the delays associated with disk accesses but is really only suitable for short documents, letters and memos. The major feature of the program is ease of learning and use, with most functions performed by the soft keys and cursor controls. The Ctrl key alters the operation of the cursor keys to allow large movements within a document, so that, for instance, pressing the right arrow key moves the cursor forward character by character while pressing Ctrl/right arrow moves the cursor forward word by word. Printing configurations are particularly versatile, using a series of printer drivers stored on disk. For a portable machine which may be used with a number of different

printers the ability to create and recall several different printer configurations is a particular advantage.

Lotus 1-2-3 is possibly the biggest-selling program for the IBM PC and other compatible machines. It is a combination spreadsheet, database manager and business graphics package with some word processing capabilities, integrated to allow the same data to be used as the basis for a spreadsheet, graphics and database without multiple keyboard entries or disk files. The high resolution and shading capabilities of the Hyperion are particularly effective in producing the line, bar and pie charts catered for by Lotus, while the soft keys are used to good effect to ease the task of learning and using the program. A tutorial disk provided with the program takes the user through demonstrations and examples of the most commonly used procedures.

Word processing and spreadsheet programs probably cover 90% of the business uses of microcomputers such as the Hyperion, but in addition Bytec publishes a monthly list of tested software which has been found suitable for their machine. The list we saw contained well over 200 programs, including Peachtree accounting software, dBase II, the Condor 3 database manager, games from Avalon-

Hill, the "Perfect" series 'Filer, 'Speller, and 'Writer, PFS packages, Visicalc IV, the Lattice C compiler, Microsoft Cobol and Fortran compilers and UCSD Pascal. Most other IBM PC programs will also run on the Hyperion, the exceptions being those which use specialised video display or disk routines rather than working through MS-DOS. Shortage of software is not likely to be a problem for the Hyperion user.

## GWBasic

The first versions of the Hyperion to be sold supplied Microsoft's GWBasic rather than BasicA as originally intended. A note in the front of the Hyperion Programmer Guide lists the differences between the two versions, chiefly the wording of error messages and the exact requirements for some of the graphics statements, but confusion can still arise because the manual lists statements such as ON COM which are not in fact available in GWBasic.

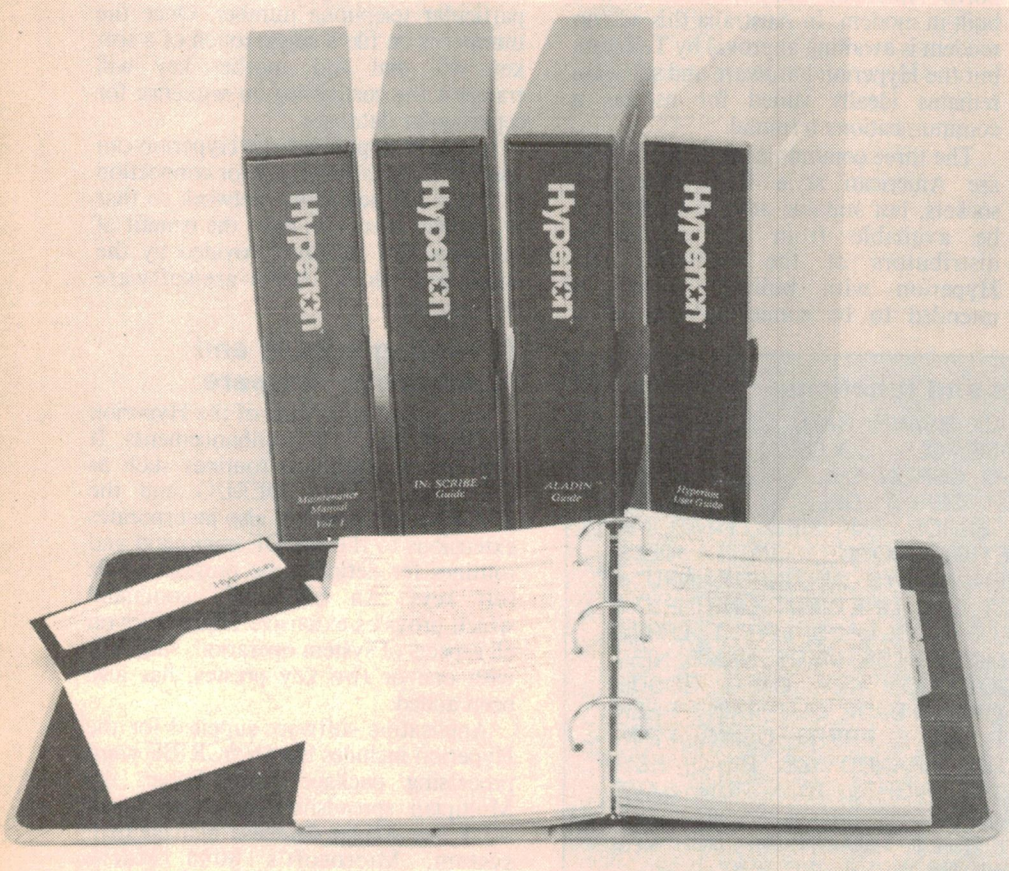
Both versions of the language are extensively enhanced compared to earlier Basic interpreters, particularly with regard to graphics, sound and I/O capabilities.

Display modes are selected by the SCREEN statement, which also controls which of the text pages will be displayed. With a graphics mode selected, the statements PSET, LINE and CIRCLE are available for drawing points, lines and curves. All take options to control attributes such as shading and can be used with both absolute and relative coordinate systems. LINE with an optional "b" will draw a rectangle while adding an "f" will fill the shape in to create a solid pattern.

The DRAW command takes a string of arguments to specify movement of the drawing point, rotation and scaling, and also allows the addition of "subroutines" which can be separate strings of arguments called from the main string. DRAW is really another language in itself. The statement PAINT is also available for filling irregular shapes and circles, while once created, shapes can be stored and retrieved in arrays with the GET and PUT statements. This allows a limited form of animation at the cost of using considerable amounts of memory.

The internal sound generator of the Hyperion is controlled by the statements BEEP, SOUND, and PLAY. BEEP produced a fixed frequency, fixed length tone and SOUND allows both the frequency and duration of the sound to be specified, with a frequency range of from 32Hz to over 32kHz and a duration of up to 65535 "ticks" at 18.2 ticks to the second. The ultrasonic frequencies are of limited utility!

Like DRAW, the PLAY statement takes a string of parameters specifying



The software includes word processing, spreadsheet and database management programs.



## Hyperion specifications

Processor	8088 at 4.77MHz with provision for 8087 numeric co-processor.
RAM	256K with additional 20K screen memory
ROM	8K for boot-up and diagnostics
Interfaces	Parallel and RS232C ports, connections for telephone and modem (pending Telecom)
Keyboard	84 keys with numeric keypad and 10 programmable keys
Display	17.8cm built-in amber screen, 80 x 25 lines, IBM colour graphics emulation.
Software	MS-DOS BasicA and 8086 macro-assembler supplied, PM/M-86 available and other programs as listed by distributor
Documentation	Clear and well organised but lacking in technical detail. Technical Manual available separately.

musical notes, octaves (over a range of seven), note length and tempo. Strangely, however, there is no volume control parameter listed in the manual.

Input/Output and print formatting capabilities are extensive, with both random and sequential access disk files supported and provision for interrupts generated by the programmable function keys and the communications ports of the Hyperion. The PRINT USING and LOCATE statements allow screen displays to be designed to any degree of complexity and there is a single key screen dump routine to reproduce screen displays on a dot matrix printer.

Machine language programmers are also well supported, with statements including CALL and USR for interfacing to machine code routines from Basic. DEF SEG also allows a form of memory management to be included in programs

so that separate areas of memory can be set aside for programs, data and machine language routines.

A full screen editor, automatic line numbering, renumbering and TRON and TROFF statements are a boon to the programmer, easing the task of creating and testing Basic programs.

While the average user of the Hyperion will probably spend most time using "off the shelf" programs for business applications, the availability of a standard form of Basic means that programs can be written for special applications without fuss. Since the power and completeness of the language eases the task of the programmer, it also benefits the user by ensuring a supply of high quality software for all applications.

## Documentation

The Hyperion is accompanied by a

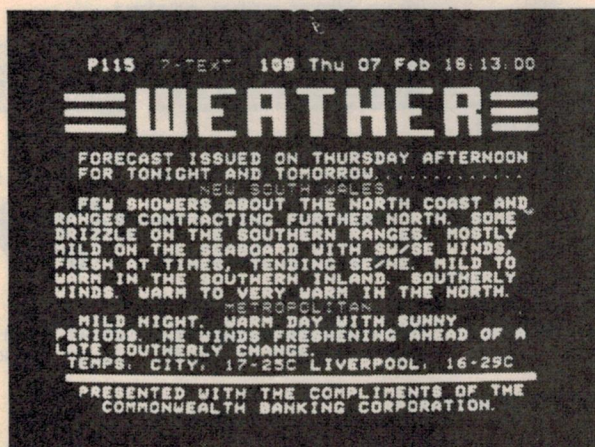
soft cover "Set Up Guide" and User and Programmer Guides in ring binders packaged in linen-slip covers. While adequate for the user concerned with running pre-packaged software and for Basic programming, none of these manuals contain technical details. People interested in machine language programming or hardware expansion will look in vain for a memory map or description of the pinouts of the expansion connector. Apparently a technical guide is available separately and hopefully it will correct this short-coming.

## Conclusion and pricing

Ease of use and transportability are the main features of the Hyperion personal computer. It provides a substantially IBM PC-compatible machine with the hardware and software features most required by the business and professional user in one compact package. The availability of a built-in modem and communications software will substantially increase its appeal to workers who value mobility and will equip the Hyperion to take advantage of the ever-increasing applications of data communication. At \$5995 for a dual disk drive version (including sales tax and some software) the Hyperion is not cheap, but it still represents good value for money.

The Hyperion is distributed in Australia by Hyperion Computer Systems, 8th Floor, 275 Albert St, North Sydney, 2060. Phone (02) 92 0729.

# Next month in Electronics Australia\*



## Teletext decoder

You don't have to trade in your colour TV set to receive teletext. Next month, we intend to describe a teletext decoder which mates with your VCR and provides the full range of teletext functions. The circuit is all on a single PC board and is very easy to build.

## Sustain unit for guitars

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## Electronics and your new Holden

GM's new Commodore cars incorporate some interesting electronics for entertainment, display and engine management. We take a look at what the new cars offer.

## Sanyo CP-400 CD player

New from Sanyo, the CP-400 is a fully-featured compact disc player with infrared remote control. We review this interesting newcomer in August EA.

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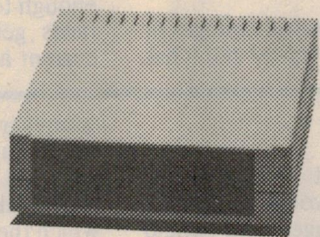


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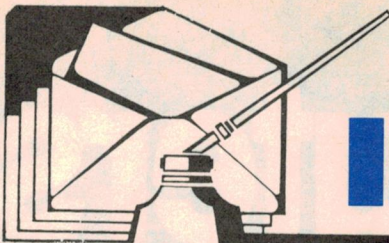
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# Information centre

**LCR BRIDGE:** I have been following with interest your recent series of articles on "A Versatile LCR Bridge" in EA March, April and May and note that a number of precision resistors of  $\pm 0.1\%$  tolerance are specified. These are not a common tolerance and are not available locally — the best that I can find here are  $\pm 1\%$  tolerance.

I was expecting that you would mention some suppliers of these resistors in the construction article but I did not see any mention of them. Could you please tell me where I can obtain some of these  $\pm 0.1\%$  tolerance resistors? (B.G., Carlisle, 6101).

• The wholesale source of  $0.1\%$  resistors for the LCR Bridge was Mayer Kreig & Co, 49/51 Brodie St, Rydalmere NSW. Retail enquiries should be directed to Radio Despatch Service, 869 George St, Sydney Phone (02) 211 0816. Radio Despatch Service are also able to supply a complete kit for the LCR Bridge which is also available from Geoff Wood

Electronics Pty Ltd, 656A Darling St, Rozelle 2039 (phone 810 6845); Rod Irving Electronics, 425 High St, Northcote 3070 (phone (03) 489 8866); and Kitronics, PO Box 126, Epping 3076 (phone (03) 439 3591).

**LIGHT BULBS & FITTINGS:** I've just bought a home unit and for reasons of cheapness, the builder fitted all incandescent light fittings. It would have been cost effective for me at construction time to specify fluorescent fittings but I wasn't asked. I now either have to replace all the fittings or live with a higher power bill each quarter.

I realise that Philips now markets its "SL" series fluorescents which fit into an incandescent bulb socket, but they don't fit into most light fittings and they're horrendously expensive.

What puzzles me is why I can't replace the standard incandescents with quartz halogen globes?

It's not as if QH has no advantages (it needs no transformer or starter and it has

the efficiency of fluorescents without the initial cost) or is new or unproven — QI bulbs have just about taken over the market for new car headlamps. The price would be higher, but the bulb's lifetime would be fantastic. It would seem trivial to re-engineer a car headlight QI bulb for about 26W output at 240VAC and to make it fit a domestic incandescent socket.

Perhaps you could, at some time, either explain this little matter of get an explanation from the appropriate manufacturers. (G.D., Ultimo, 2007).

• Unfortunately, engineering quartz/halogen lamps to work from 240VAC is not all that easy. For the halogen cycle of evaporation and re-deposit back onto the filament to work correctly the filament must run extremely hot. To do this it must be very compact and, at the same time, rugged enough to withstand the strong magnetic fields generated by the initial in-rush current at switch-on.

## Comments on the Car Burglar Alarm

**CAR BURGLAR ALARM:** I read with interest the details of your recent car alarm project in EA, May 1984. No doubt there are many ways of designing circuitry to satisfy the performance specifications of devices for this purpose and Messrs Clarke and Swain seem to have arrived at a very practicable solution to the problems posed.

There is however one drawback that I see in this design as in many others. As presented, the project does not permit independent access by legitimate users to the boot of a sedan or the load compartment of a station wagon, when the alarm is operative, without first opening the door of the driving compartment and turning off the alarm.

Such a requirement is everyday for many vehicle users, particularly handymen, housewives, golfers and retired people although perhaps not so for the car driving commuter. The inconvenience of first having to open the driving compartment to disable the alarm before opening the boot or tailgate would, I believe, cause the alarm to be not used in the theft-prone conditions of supermarket or shopping centre car parks.

It seems to me that a very simple addition to the circuit would completely remove the disadvantages and would also make operation of the alarm not so subject to the problem that many drivers will forget to arm it when leaving the vehicle.

The addition is of another key switch wired in series with that shown in the design as the main on/off switch. The additional switch is fitted in the boot or the load compartment of a station wagon. The locks should be arranged so that they retain the key when the alarm is switched off, ie contacts open, and of course the two locks must be keyed alike (operated by the same key).

If the alarm key is connected by a short chain to the ignition key there will be a constant reminder to the driver to enable the alarm every time the car is left.

The operation is quite simple of course. The alarm key is normally in the driving compartment alarm lock. When the car is left the alarm is turned on and the key removed.

If access to the boot is required, for example, to deposit the groceries before going on to the library or the butcher or

wherever, the boot is opened and the alarm turned off with the key switch mounted therein. The key is retained until the alarm is turned on again after which the boot lid or tail gate can be closed again.

A small buzzer somewhere in the vehicle, operated by the door switches and powered from the alarm switched supply, will serve as a reminder to the user that the alarm is on and will cause embarrassment unless switched off in time.

If the magnetic switch entry delay facility is fitted to the driver's door, then another reed switch in parallel with the first should be fitted as the rear end. For shoppers this facility may be just one more complexity that the harassed user will not remember, with consequent embarrassment when the alarm goes off, so when I build the device I probably won't use it. (J.M., East Bentleigh, Vic).

• The question of access to the boot in shopping centre car parks is a good one. Your solution would appear to be a practical answer. Alternatively, a simple modification would involve the installation of a shorting switch across the boot switch. Before setting out on a shopping trip, the driver would open the boot and set the switch which would



It is easy to arrange for a compact and rugged filament for a car headlamp. The very fact that it operates at low voltage means that for a given power, the filament will be short, to give the necessary low resistance. By contrast, a 240VAC filament for a 26W lamp (your example) is a very fragile affair and if it is bunched up to form the compact structure it is liable to fracture at switch-on.

The quartz glass bulb also needs to be quite small to obtain the necessary high operating temperatures and for a rating of 26W it would be impractically small to fit standard bayonet sockets. The small bulb also means that a quartz halogen lamp is not a diffuse light source. This is not really suitable for most domestic applications.

It is significant that the only readily available 240VAC quartz/halogen lamp is a 500W spotlight. At such a high rating it is again relatively easy to obtain a rugged filament.

The only other lamps intended for use with the mains are either small spot lamps or projector bulbs and these are usually run from a transformer at around 24VAC.

As far as your quarterly electricity bill is concerned, fitting fluorescent lights will not make a great deal of difference. You will only make energy savings with fluorescent lights where they are used for

then disable the alarm as far as the boot was concerned.

Another alternative would be to omit the boot protection altogether. Or, as some wag in the EA office put it, don't use the car at all and take public transport. Next time he wishes to use the editor's car he will be invited to do just that!

**DELUXE CAR ALARM:** I noted with interest your latest project of the "Deluxe Car Alarm" in the May 1984 issue. Having been involved in the alarm field, I would like to offer a few suggestions, as well as to ask a question.

The XOR gate configuration used on the input will trigger the alarm when the input either goes high to low or low to high. Why then is it necessary to use transistors in an inverting mode on the "vehicle battery" and ignition inputs.

The auxiliary battery is charged from the car battery via diode D25. If this battery were to be partially or completely flat, a very high charging current would result, damaging the battery (most manufacturers suggest a maximum current of one quarter of the amp-hour rate). The following mod is suggested. (The circuit involves an additional diode and a 39 $\Omega$ /5W current limiting resistor. Ed.)

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many hours every day. For this reason, fluorescents are not suitable for use in bedrooms, bathrooms and toilets where the lights tend to be used only spasmodically.

**INFRARED REMOTE CONTROL:** I have used the remote control unit described in May 1981 to control my garage doors, one channel being used to switch each door. The circuit has been

modified to allow the unit to be switched by press buttons inside the garage area.

The diecast aluminium case, housing the preamplifier PCB has been separated from the main case. It is mounted outside the garage doors on a brick pillar facing the driveway. A shielded twin core cable connects the preamplifier to the main PCB. The unit works well but for one problem. During an electrical

Some cars have rather involved hazard blinker circuitry, requiring double-pole double-throw contacts. If this is the case, it is sometimes easier to flash the parking lights, or alternatively, some may want to pulse the car horns as well. The following modification then pulses the relay. (The writer's circuit uses the output of oscillator IC6c to drive Q4 and gates IC6c via a diode from pin 1 of IC3a Ed.)

Your average 10 watt burglar type horn will not tolerate the  $\pm 9$  watts continuous generated by the alarm. Make sure the horn is rated at 10 watts RMS.

Finally, most people seem to prefer operating the alarm by pressing a dash mounted push-button to start the alarm (exit delay) and to turn it off by operating the ignition switch. How about a mod to incorporate this?

I hope you accept my suggestions as constructive criticism and thank you for an excellent publication. (N.L., West Pymble, NSW).

● We used transistors Q1 and Q2 to isolate pins 2 and pins 5 of the exclusive-OR gates from "Ignition" and "Vehicle Battery" inputs. While resistors may have achieved the same purpose, they would have compromised the switching

action required.

Since the auxiliary battery is always connected to the vehicle battery via D25, the auxiliary battery should never become heavily discharged. In fact, the only way that we can envisage the auxiliary battery ever becoming heavily discharged is if it was disconnected from the vehicle battery for a considerable period of time. If this did happen it would be advisable to take the current-limiting precautions you mention.

While our alarm driver circuit is very efficient in applying almost the full battery supply voltage across the voice coil of the horn, the 10 watt rating is not exceeded. This is because the alarm signal has a 50% duty cycle. We estimate the power developed in the horn to be around 16 watts but that figure should be halved to 8 watts because of the 50% duty cycle.

Our prototype horn has had a good workout which would greatly exceed normal usage and it is still operational.

We specifically did not employ a circuit which would be disabled by turning on the ignition switch. After all, car thieves can enter a car and "jump-wire" the ignition within thirty seconds. That is why we designed the system around a key-switch.



# Information centre

storm the receiver will detect a lightning causing both channels to turn on.

Once both channels have been switched on further lightning strikes appear to have no effect, both channels staying on. I find the last statement hard to believe but that is what is happening. If I turn both channels off both channels turn on again at the very next strike. Leave both channels on and they stay switched on, irrespective of the number of further strikes. I would appreciate any suggestions you may have to offer or how I can make the unit less susceptible to lightning strikes. (L.W., Rochedale, 4123).

● As far as we can determine, the original circuit cannot respond to lightning and turn both channels on. However, it is possible that the extra gates you have added for your pushbutton circuit are susceptible to voltage spikes superimposed on the incoming supply line. We note that both the pushbuttons and the capacitors across them are connected to the positive rail. Maybe this is the source of your problem.

**PLAYMASTER TWIN 25:** Thank you for your excellent magazine which I

## Marantz CD-54 ... from p. 31

of play, we would rate it above average. It requires a pretty strong bump or jolt to make it misbehave and, in the normal course of events, it should never mistrack due to vibration. (We wonder how it would fare in a car — it could be quite good).

Well, it performs very well. What is it like to use? Compared with other decks we have used, the CD-54 is slow to respond to user commands. The disc drawer seems to slide in and out quite slowly and we wondered why it could not have been speeded up. Similarly, the machine is slow to respond to track selection commands, but this is not important if you do not wish to flit from track to track. Mechanical noise levels are very low.

Naturally, the quality of sound reproduction was above reproach.

For people who want a simple, easy-to-use, no frills machine with the Marantz brand name, the CD-54 is hard to go past at \$699.

For further information about the CD-54 and other Marantz products, see your hifi dealer or contact Marantz (Australia) Pty Ltd, 19 Chard Road, Brookvale, NSW, 2100, or interstate offices.

enjoy reading every month. I wonder if you can help me with a little problem I have after building a few of your projects.

It centres on the preamplifier of your Playmaster Twin 25. After building the unit all was well except for hum on the phono position which restricted the volume when playing records. This problem intensified after I added the Graphic Equaliser. Initially I blamed the turntable and magnetic cartridge, but after a little experimenting I found that when playing the gram through the microphone input of my tape deck there was not a trace of hum evident, even at high volume.

Without any load on the phono terminals of the amplifier there is only a slight hiss and buzz at high volume, but as soon as a small capacitor is connected a strong hum is introduced (equal on both channels). I would like to know if this sensitivity is inherent to this preamplifier, or would I have to look for a fault? Is there any modification possible to prevent capacitive loading to have such effect?

I have checked the earth returns, but they seem to be in order according to instructions. In the Dick Smith manual the headphone socket is mentioned as a cause of hum. The equaliser does not cause any difference in hum level in the auxiliary positions. You may be able to lay your hand immediately on the remedy from previous experiences, so I am hoping you can put me out of my misery. (S.F., Buderim 4556).

● According to our Macquarie Dictionary, the phrase "put out of misery" means to "kill or render unconscious a person or animal so as to end bodily suffering". Now while we tend to take electronics fairly seriously we think putting you out of your misery might be just a little drastic. Wouldn't it be easier to just get rid of the amplifier altogether?

It is not clear from your letter whether you have constructed a complete Playmaster Twin 25 amplifier or just the preamplifier section. Either way, the preamplifier itself is not noisy. In fact it is very quiet but the earthing is very critical if the minimum hum level is to be obtained.

If you built the complete Playmaster Twin 25 you must follow the wiring layout in the original article explicitly. The only signal earthing point in the whole amplifier is at the phono input, via an adjacent solder lug to the chassis. Any other signal earths will inevitably lead to an earth loop and resultant hum when the phono input is selected. For an

explanation, see this month's article on op amps, beginning on page 92.

At the same time, the shielded phono cables from the turntable should not be earthed via the three-core mains flex for the turntable. It is normal practice to isolate the turntable chassis which still should be earthed back via the mains cord. The tonearm earth lead can either be connected to the phono cable shield or taken back to an earth terminal on the rear of the amplifier chassis, adjacent to the phono input.

The headphone socket should be insulated from chassis using two fibre washers and insulating tape around the threaded bush. This was not specifically mentioned in the original articles in April, May and June 1976 but was noted in the article on the Playmaster Forty/Forty in January 1977.

**DOG REPELLENT:** I remember that many years ago, an issue of EA dealt with the problems of dogs making a nuisance of themselves and of chasing them away by pounding their ears with an audio frequency, above the human threshold of hearing but most annoying for dogs.

Since I am now confronted with that problem, I wonder whether you could inform me what the most effective audio frequency is for the abovementioned purpose and the circuit diagram for such an oscillator. If you would inform me by letter or via an article on the subject, I will be very much obliged. (H.W., Meltham, 6053).

● The concept of a supersonic dog repellent seems to periodically come into vogue with electronic enthusiasts so your request is not an uncommon one. In fact, our Super Siren, described in the November 1982 issue would seem to be almost ideal for the purpose. It uses a cheap piezoelectric tweeter and could be easily modified to run in the supersonic region.

We do not know what frequency would be the most effective. It seems probable that although dogs may hear supersonic frequencies, their hearing is probably most acute at frequencies within the human-audible range.

In any case there is another consideration and that is the efficiency of the tweeter itself. This falls as the frequency rises so that the optimum frequency will be just above 20kHz where it won't cause any human discomfort.

There are two possible drawbacks in the idea. First, while the dogs may be discomforted by such an audible onslaught, they may not be scared off. A shouted "Gitoutofit" may be far more effective, particularly when followed by a suitable flying object. Second, many older dogs are deaf!



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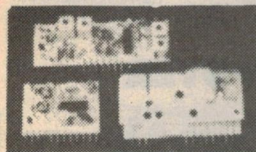
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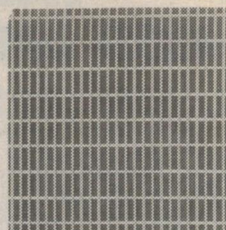
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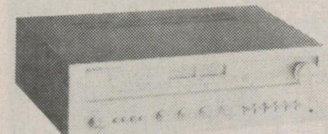
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Capacity (formatted) 163K (20K bytes more than the original)  
No. of tracks 40 tracks (5 tracks more)  
No. of sectors track 13 to 16 sectors.  
Disk rotation speed 300 rpm  
Track density 48TPI  
Track to track time Less than 6 msec

**\$349.00**

**INCLUDES  
CONTROLLER  
CARD**

**BARE DRIVE & CASE**

**\$299.00**



**OTHER CARDS  
ALSO AVAILABLE.  
ASK AT OUR CITY STORE.**

## DO YOU NEED A CASE FOR A SINGLE BOARD COMPUTER

This stylish low profile case will give your system the professional look it needs. This case comes complete with an encoded, parallel output keyboard. The keyboard is in its own case attached via a coiled connector, so it can be placed for maximum comfort. Sit one of our new swivel monitors on top and make your system look like it's worth thousands. Cut outs are for 2 x 5 1/4 in Slimline disk drives.

**GREAT FOR SINGLE BOARD COMPUTERS, TERMINAL CARDS, ETC.**

**CASE AND ENCODER KEYBOARD \$249.00 Tax Ex \$199.00**

Dimensions:

Box W D H  
450mm 295mm 110mm  
Box Cat. No. X11080

Dimensions:

Keyboard W D H  
450mm 195mm 40 (28mm)  
K/B Cat. No. X11081



ERRORS AND OMISSIONS EXCEPTED

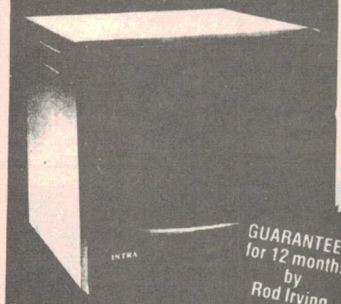
### NEW VIDEO MONITORS

**Get a clear honest image!**

Computer data and graphic displays never looked better, brighter, sharper

### High Resolution

- Recommended Display Characters: 1920 (80x24).



**GUARANTEED  
for 12 months  
by  
Rod Irving**

**SCHOOL AND CLUB BULK BUYS**  
Please ring for pricing

- High quality non-glare CRT
- Compact and Lightweight with all Controls inside Front Panel
- All units 100% Factory Burned in
- 800 lines centre resolution
- Suitable for Apple\* — and other computers. (Apple is a registered trademark of Apple Computer Company Inc)
- Green or Orange Phosphor available
- 18MHz
- First shipment arriving middle of June, 1983
- Direct Import Price for June

Green Phosphor **\$189** (\$162 Exempt)  
Orange Phosphor **\$199** (\$179 Exempt)

**GREAT VALUE**

## ROD IRVING ELECTRONICS

425 High St., Northcote, Vic. 48-50 A Beckett St., Melb., Vic.  
Phone (03) 489 8866, (03) 489 8131, Mail Order Hotline (03) 481 1436  
Mail orders to P.O. Box 235 Northcote 3070 Vic.

## 'THE PRINTER PEOPLE' SPECIALS

**AS REVIEWED BY EA NOVEMBER '83**

**THESE ARE THE REAL THING.  
NOT A CHEAP SUBSTITUTE.**

### A NEW PRINTER NOW! CP-80/I, 80-COLUMN IMPACT PRINTER

#### SPECIFICATIONS

##### Functional Specifications

Printing method — Serial impact dot matrix. Printing format — Alpha-numeric — 7 x 8 in 8 x 9 dot matrix field. Semi-graphic (character graphic) — 7 x 8 dot matrix. Bit image graphic — Vertical 8 dots parallel horizontal 640 dots serial line.

Character size — 21mm (0.083")-W x 2.4mm (0.09")-H 7 x 8 dot matrix.

Character set — 228 ASCII characters. Normal and italic alpha-numeric fonts, symbols and semi-graphics.

Printing speed — 80 CPS 640 dots/lines per second.

Line feed time — approximately 200 msec at 4.23mm (1/6") line feed.

Printing direction — Normal — Bidirectional logic seeking. Superscript and bit image graphics — Unidirectional left to right.

Dot graphic intensity — Normal — 640 dots 190.5mm (7.5") line horizontal. Compressed characters — 1,280 dots/190.5mm (7.5") line horizontal. Line spacing — Normal — 4.23mm (1/6"). Programmable in increments of 0.35mm (1/72") and 0.118mm (1/215").

Columns/line — Normal size — 80 columns. Double width — 40 columns. Compressed print — 142 columns. Compressed double width — 71 columns. The above can be mixed in a line.

Paper feed — Adjustable sprocket feed and friction feed.

Paper type — Fanfold Single sheet. Thickness — 0.05mm (0.002") to 0.25mm (0.01"). Paper width — 101.6mm (4") to 254mm (10").

Number of copies — Original plus 3 copies by normal thickness paper.

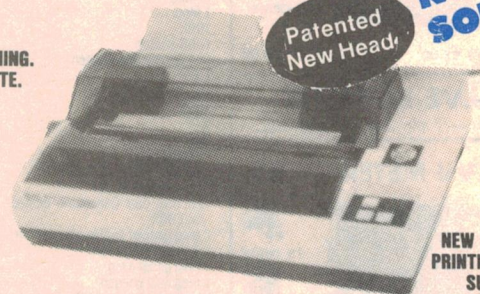
##### Mechanical Specifications

Ribbon — Cartridge ribbon (exclusive use), black.

MTBF — 5 million lines (excluding print head life).

Print head life — Approximately 30 million characters (replaceable).

Dimensions — 377mm (14.8")-W x 295mm (11.6")-D 125mm (4.9")-H incl sprocket cover.



**NEW DELUXE  
PRINTER NOW  
SUPPLIED**

**500  
NOW  
SOLD**

**Parallel CP 80**

**\$359**

**Serial CP80**

**\$559**

**2000 Sheets "Keen Edge" Paper \$39.50**

Minimum P & P \$3.00. Errors & omissions excepted.  
Please address tax exempt, school, wholesale and dealer enquiries

### RITRONICS WHOLESALE

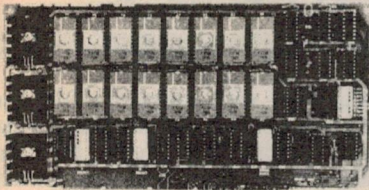
1st floor 425 High St. Northcote 3070 (03) 489 7099 (03) 481 1923  
Telex AA 38897

**DEALER ENQUIRIES ESPECIALLY WELCOME ON ALL THESE PRODUCTS**



# S100 PRODUCTS

## 32K S-100 EPROM CARD PRICE CUT!



**\$99.00**

USES 2716's

Blank PC Board — \$69

ASSEMBLED & TESTED  
ADD \$49.00

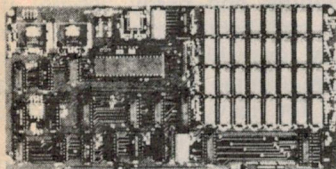
### KIT FEATURES

1. Uses +5V only 2716 (2Kx8) EPROM's
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible
4. Addressable as two independent 16K blocks
5. Cromemco extended or Northstar bank select
6. On board wait state circuitry if needed
7. Any or all EPROM locations can be disabled
8. Double sided PC board, solder-masked, silk-screened
9. Gold plated contact fingers
10. Unselected EPROM's automatically powered down for low power
11. Fully buffered and bypassed
12. Easy and quick to assemble

## 256K S-100 SOLID STATE DISK SIMULATOR! WE CALL THIS BOARD THE "LIGHT-SPEED-100" BECAUSE IT OFFERS AN ASTOUNDING INCREASE IN YOUR COMPUTER'S PERFORMANCE WHEN COMPARED TO A MECHANICAL FLOPPY DISK DRIVE.

### FEATURES:

- \* 256K on board, using + 5V 64K DRAMS.
- \* Uses new Intel 8203-1 LSI Memory Controller.
- \* Requires only 4 Dip Switch Selectable I/O Ports.
- \* Runs on 8080 or Z80 S100 machines.
- \* Up to 8 LS-100 boards can be run together for 2 Meg. of On Line Solid State Disk Storage.
- \* Provisions for Battery back-up.
- \* Software to mate the LS-100 to your CP/M\* 2.2 DOS is supplied.
- \* The LS-100 provides an increase in speed of up to 7 to 10 times on Disk Intensive Software.
- \* Compare our price! You could pay up to 3 times as much for similar boards.



BLANK PCB  
(WITH CP/M\* 2.2  
PATCHES ON DISK)  
**\$99.95**

**\$699.00**

#LS-100 (FULL 256K KIT)

**ALLOW 4-6 WEEKS DELIVERY**

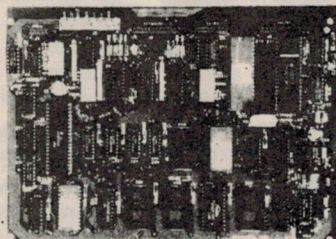
## THE NEW ZRT-80

### CRT TERMINAL BOARD!

A LOW COST Z-80 BASED SINGLE BOARD THAT ONLY NEEDS AN ASCII KEYBOARD, POWER SUPPLY, AND VIDEO MONITOR TO MAKE A COMPLETE CRT TERMINAL. USE AS A COMPUTER CONSOLE, OR WITH A MODEM FOR USE WITH ANY OF THE PHONE-LINE COMPUTER SERVICES.

### FEATURES:

- \* Uses a Z80A and 6845 CRT Controller for powerful video capabilities.
- \* RS232 at 16 BAUD Rates from 75 to 19,200.
- \* 24 x 80 standard format (60 Hz).
- \* Optional formats from 24 x 80 (50 Hz) to 64 lines x 96 characters (60 Hz).
- \* Higher density formats require up to 3 additional 2K x 8 6116 RAMS.
- \* Uses N.S. INS 8250 BAUD Rate Gen. and USART combo IC.
- \* 3 Terminal Emulation Modes which are Dip Switch selectable. These include the LSI-ADM3A, the Heath H-19, and the Beehive.
- \* Composite or Split Video.
- \* Any polarity of video or sync.
- \* Inverse Video Capability.
- \* Small Size: 6.5 x 9 inches.



BLANK PCB WITH 2716  
CHAR. ROM, 2732 MON. ROM

**\$99.00**

SOURCE DISKETTE - ADD \$20

SET OF 2 CRYSTALS-ADD \$12

# ZRT-80

WITH 8 IN.  
SOURCE DISK!

**\$189.00**

(COMPLETE KIT,  
2K VIDEO RAM)

**ALLOW 4-6 WEEKS DELIVERY**

## 64K S100 STATIC RAM

**\$499.00**  
KIT

**NEW!**

LOW POWER!

RAM OR EPROM!

BLANK PC BOARD  
WITH DOCUMENTATION  
**\$119.00**

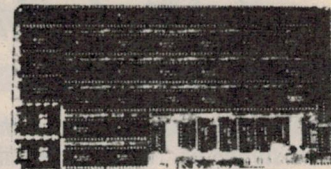
SUPPORT ICs + CAPS  
**\$29.00**

FULL SOCKET SET  
**\$19.00**

FULLY SUPPORTS THE  
NEW IEEE 696 S100  
STANDARD  
(AS PROPOSED)

FOR 56K KIT \$419

ASSEMBLED AND  
TESTED ADD \$50



### FEATURES:

- \* Uses new 2K x 8 (TMM 2016 or HM 6116) RAMS.
- \* Fully supports IEEE 696 24 BIT Extended Addressing.
- \* 64K draws only approximately 500 MA.
- \* 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- \* SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
- \* 2716 EPROMs may be installed in any of top 48K.
- \* Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
- \* Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
- \* BOARD may be partially populated as 56K.

## 64K SS-50 STATIC RAM

**\$359.00**  
(48K KIT)

**NEW!**

LOW POWER!

RAM OR EPROM!

BLANK PC BOARD  
WITH  
DOCUMENTATION  
**\$119.00**

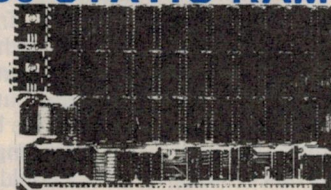
SUPPORT ICs + CAPS

FULL SOCKET SET

56K Kit \$419

64K Kit \$499

ASSEMBLED AND  
TESTED ADD \$50



### FEATURES:

- \* Uses new 2K x 8 MK58725P RAMS.
- \* Fully supports Extended Addressing.
- \* 64K draws only approximately 500 MA.
- \* 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
- \* Board is configured as 3-16K blocks and 8-2K blocks (within any 64K block) for maximum flexibility.
- \* 2716 EPROMs may be installed anywhere on Board.
- \* Top 16K may be disabled in 2K blocks to avoid any I/O conflicts.
- \* One Board supports both RAM and EPROM.
- \* RAM supports 2MHZ operation at no extra charge!
- \* Board may be partially populated in 16K increments.

## 32K S100 EPROM/STATIC RAM

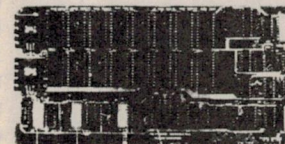
**NEW!**

### FOUR FUNCTION BOARD!

**NEW!**

EPROM II  
FULL  
EPROM KIT  
\$129

A&T EPROM  
ADD \$35.



BLANK  
PC BOARD  
WITH DATA  
**\$69.00**

SUPPORT  
IC'S  
PLUS CAPS  
**\$29.00**

FULL  
SOCKET SET  
**\$25.00**

We took our very popular 32K S100 EPROM Card and added additional logic to create a more versatile EPROM/RAM Board.

### FEATURES:

- \* This one board can be used in any one of four ways:
  - A. As a 32K 2716 EPROM Board
  - B. As a 32K 2732 EPROM Board (Using Every Other Socket)
  - C. As a mixed 32K 2716 EPROM/2K x 8 RAM Board
  - D. As a 32K Static RAM Board
- \* Uses New 2K x 8 (TMM2016 or HM6116) RAM's
- \* Fully Supports IEEE 696 Buss Standard (As Proposed)
- \* Supports 24 Bit Extended Addressing
- \* 200 NS (FAST!) RAM'S are standard on the RAM Kit
- \* Supports both Cromemco and North Star Bank Select
- \* Supports Phantom
- \* On Board wait State Generator
- \* Every 2K Block may be disabled
- \* Addressed as two separate 16K Blocks on any 64K Boundary
- \* Perfect for MP/M\* Systems
- \* RAM Kit is very low power (300 MA typical)

**32K STATIC RAM KIT — \$199.00**

For RAM Kit A&T - Add \$40



# 50 and 25 years ago...

*"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.*



**JULY, 1934**

**Empire stations:** It is pleasing to note reception of excellent signals from Daventry in Transmission No. 4 which extends from 9 to 11am daily. Daventry operates on 31.5 and 25.4 metres but of these GSD on the latter is much the better. Signals reach good speaker strength, and the news session at 10.45 could be copied 100 per cent on most occasions during the week.

**Wave-wobble snoopers:** The Federal Radio Commission of America has decided to build mobile monitoring cars to check the wave-wobble of stations by patrolling the country at all times without the knowledge of station engineers; the cars and instruments will cost about \$25,000.

**Not quite radar — yet!** A range finder that automatically, and continuously records distance, as well as direction, is a development of Mr Emil J. Simon, of New York. Mr Simon's invention promised to eliminate collisions at sea during fogs. Present direction finders do not record distance and are manually operated. The Simon finder is automatic, giving both direction and distance from the radio station or beacon.

**Car radios:** American radio manufacturers hope to sell between one million and two million car radios this summer season; June 10 to 16 was to have been car-radio week, and the idea dominating all advertising campaigns is "Listen as You Ride".

**Police radio:** The Brighton (England) police have been installed with pocket receivers (size!); each man on each 22 beats has one, and reception is said be better than reception in cars.

**Sending and receiving plates?** A Dr Oartel, of Wilksburg, New York, told the Pennsylvania Dental Society that germs in diseased teeth can be killed by placing the tooth between the sending and receiving plates of a simple short-wave set.

**Ladies Lib:** Miss Natalie Piskor is claimed to be the only woman broadcasting engineer in Europe; she has been in the control room of the Warsaw station for some years.



**JULY, 1959**

**AM stereo — the Kahn system:** The transmission of stereo on conventional broadcast bands presents fascinating possibilities and is being intensively developed in line with the rapid growth of stereo in the recording field. Yet another method has been announced in America.

Conventional AM transmitters can easily be converted for stereophonic broadcasting with adapters developed by Kahn Research Labs Freeport, NY. In the combined stereo/compatible single-sideband system two sidebands are produced that are independently modulated by the two stereo channels. The resulting envelope wave has the same spectrum requirements as conventional AM and is theoretically free from distortion.

**Editor's Note:** One of the present day AM stereo systems is known as the Kahn system, and uses independent single sideband signals to provide the two channels.

**Birth of the IC?** In recent months, there has been noticeable interest in what has been termed integrated molecular electronics — the combining of the passive functions of resistance, capacitance and

inductance with the active function of amplification in a single, semiconductor solid circuit. Now, Texas Instruments has announced developmental models of such devices.

Two circuits, each less than 1/4 by 1/8 by 1/32in, were demonstrated by the firm. The first is a multivibrator circuit, containing 12 components — two diffused-base transistors, two capacitors and eight resistors. The second is an oscillator circuit, containing nine components — five resistors, three capacitors and one transistor.

These circuits represent a component density of up to 34 million parts per cubic foot.

**NiCads aren't new:** A new kind of battery is being used in some aircraft, partly because it gives unusually long life, partly because it works well at low temperatures and partly because it is smaller and lighter than the batteries formerly available. It is the nickel-cadmium alkaline battery recently made suitable for heavy duty by introducing sintered plate construction.

The electrodes are made by sintering carbonyl-nickel powder on to a supporting framework of wire mesh or perforated strip. The battery has an extremely low internal resistance and the ability to do its work at low temperatures.

**We're still waiting:** Designers of TV display tubes are still working towards the day when they will be able to produce a flat screen device which can be mounted on a wall for easy viewing.

Many ideas have been demonstrated, but there remains a great deal to be done in extending these and other schemes to meet the requirements of commercial television. All in all, it appears that the advent of mural television on a commercial basis is not imminent.

**Hovercraft "flies":** The Hovercraft flew last month for the first time at Cowes (Isle of Wight). The wind, which had been blowing in hard gusts, all day, abated sufficiently for the flight, a spokesman for Saunders-Roe said. The craft flew, untethered and up to a foot off the ground. The spokesman said the flight showed work was going according to plan. The machine is believed to weigh about two tons and to be able to move at speeds of up to 30 miles an hour "resting" on a cushion of air about three feet off the ground.

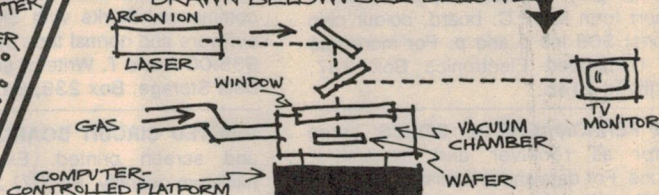


## SPITTING CHIPS

THE SEMICONDUCTOR INDUSTRY, CONTINUALLY FALLING OVER ITSELF TRYING TO IMPROVE ON THE CHIP AND ITS PRODUCTION, IS ON THE BRINK OF TIDYING UP WHAT HAS BEEN A COMPLICATED AND SOMEWHAT MESSY BUSINESS BY USING LASERS AND REAL SKINNY HIGH ENERGY ION BEAMS.



CALIFORNIAN CHIPOLOGISTS RECKON PRESENT SLOPPY PRODUCTION STEPS, LIKE, HANDLING WET AND DRY SILICON WAFERS, ALIGNING DIFFERENT MASKS ON THE CHIP NEE WAFER, COATING THE WAFERS WITH LIGHT SENSITIVE RESISTS, AND OTHER STUFF LIKE THAT, CAN BE ELIMINATED BY DOING STUFF LIKE WHAT'S DRAWN BELOW. SEE BELOW.



MEANWHILE, HIGH-TECH HOTSHOTS IN GREAT BRITAIN ARE ATTEMPTING TO SHOOT MEGA-NARROW BEAMS OF HIGH ENERGY ARSENIC AND BORON IONS AT TINY LITTLE SPOTS ON SILICON WAFERS TO MAKE THOSE TINY LITTLE SPOTS CONDUCT ELECTRICITY, INSTEAD OF SPRAYING THE STUFF ALL OVER THE PLACE.

THE IONS ARE CALLED DOPANTS BECAUSE THEY DOPE BITS OF THE CHIP SO IT WILL... YOU ATE THE WRONG CHIP YOU DOPE.



A TINY LITTLE SPOT IS EQUAL TO ONE MICROMETER OR LESS

IN FACT, A THOUSAND CIRCUIT ELEMENTS A SECOND COULD BE PRODUCED WITH ONE OF THE LASER-TYPE GIZMOS. WHAT WILL THEY COOK UP NEXT?

## MACPLASTICS TREND SETTER MICROCHIPS

NEXT!

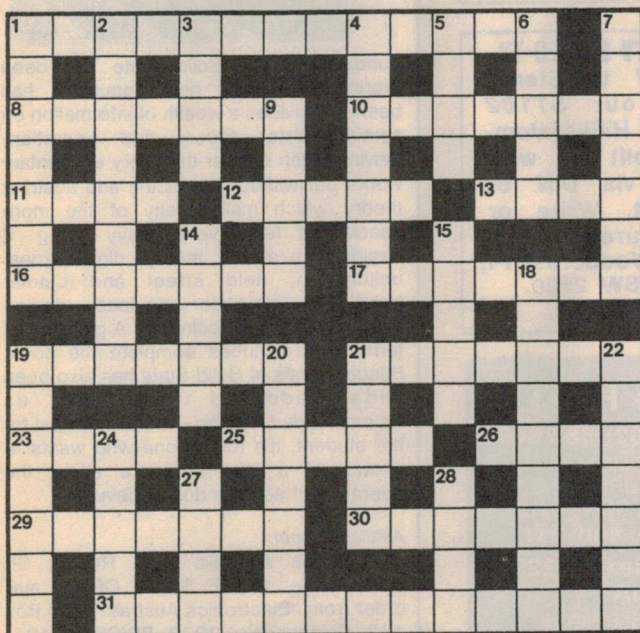


STURTH! A SQUIRT OF SAUCE WOULDN'T GO ASTRAY.

## JULY CROSSWORD

### ACROSS

1. This containment system apparently enclosed 31 across! (8,5)
8. Possible description of a radio antenna connection. (1,1,5)
10. Early active satellite. (7)
11. Tape deck component. (4)
12. Power source. (5)

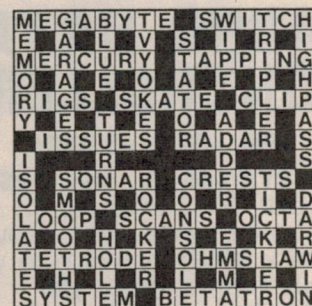


13. Computer data unit. (4)
16. Forcing an oscillation. (7)
17. Puts data on magnetic tape. (7)
19. Forms a joint. (7)
21. Potential difference. (7)
23. Form a PC pattern. (4)
25. Type of plug. (5)
26. Tape recorder key. (4)
29. Historic radio scientist. (7)
30. Tool for bridges? (7)
31. Region around a charge. (8,5)

### DOWN

1. Connected to ground. (7)
2. Type of layer common in a semiconductor. (9)
3. Listens in to telephone conversation. (4)
4. Kind of radio receiver. (1,1,5)
5. This reading may be sought in a bridged circuit. (4)
6. Unit of computer input. (5)
7. Bases for windings. (7)
9. Sound of an instrument which is not wireless! (5)
14. Conductors. (5)
15. Ratio of reduction, e.g. of an IC pattern. (5)
18. Aspect of impedance. (9)
19. Electric discharge effect known as — fire. (2,5)
20. Type of trigger. (7)
21. Power amplifiers have these for cooling. (5)
22. Came to the end of useful life. (7)
24. Name of point at which ferromagnetic properties change abruptly. (5)
27. Add a small amount of impurity to a semiconductor. (4)
28. Type of wave rectification. (4)

## SOLUTION FOR JUNE





## FOR SALE

**SUPER 80 COLOUR:** 32x16 format extendable to 64x16. Independent foreground and background, 12 colours plus black, white, grey — nibble mapped onboard Ram. Short form kit (P.C. board, colour chip instructions) \$66 inc p and p. For more info SAE to Chipspeed Electronics Box 337, Wentworthville 2145.

**AMIDON FERROMAGNETIC CORES:** Large range for all receiver and transmitter applications. For data and price list send 105 x 220 SASE to: R.J. and U.S. Imports, PO Box 157 Mortdale, NSW 2223.

**SUPER 80 USERS:** Software on tape from \$5 Super Expansion board Kit, \$45. Gives you a Centronics and Atari joystick interfaces, 2 paddles, sound generator, I/O ports. Write to: Matrix Software, PO BOX 291 Kensington 2033.

**SCANNER LISTINGS:** 27-510Mhz. Over 1600 Vic stations listed in freq and alpha sorted order. \$9.95. Kasp Electronics, PO Box 408 Noble Park 3174.

**TURNTABLE:** JHSME 3009 Series. 2 Shure V15 Type V. All accessories Approx. \$1 000 retail. Will accept \$300.00. S. Rowell, Dromana Vic 3936 Telephone (059) 87 1248.

**DISK DRIVES:** Japanese slim type for APPLE: \$299, i/f card \$60. P and P, insur, 3 mth warranty incl. Write for catalogue. Sultan Micro, PO Box 232, West Ryde 2114.

## AGRO DATA CONTROLLERS

PH. (075) 62 2329

For **SYSTEM-80** and **TRS-80** Model 1 Computers. Full expansion unit with Double Density **\$550** or made to your requirements. RS232 **\$98** — Disk Controller kit **\$119** — Double Density kit **\$130** — Assem **\$180**.

Make your own printed circuits and labels with:

### (1) "THE MINILIGHT" ULTRA VIOLET LIGHT EXPOSURE BOX

• Bell timer • Neon Indicator • Instructions on UV processes • Handles 157 X 88mm. • Easily assembled kit

**\$79.00** including postage.

### (2) THE ETCHING STATION

• Adjustable fan/heater • Heavy duty polyethylene base • Etching dish • Tongs and brush

**\$39.00** including postage

**SESAME ELECTRONICS**

Box 452, Prahran  
Vic. 3181 (03) 527 8807

**SUPER-80:** Hi-res graphics. Six pages of 256x160 bit-mapped pixels with UC and LC text. Fast machine code utilities for dot, line, circle and test drawing. \$40.00 kit, \$65.00 A and T. Also the MDS fast cassette system: More reliable and 10 times faster than normal system. Printer routines and 12 extra monitor commands. Works with 3MHz speed-up, all software and normal tape system. \$25.00 kit, \$35.00 A and T. Write or send order to Micro Data Storage, Box 239, Bexley, 2207.

**PRINTED CIRCUIT BOARDS:** Designed, built and screen printed. Excellent rates, no minimum quantity. Ph (07) 284 9274.

**CPM USERS GROUP:** Disks, up to vol. 93 8" ssd \$9 Microbee, Kaypro, Xerox, Osbourne, Excalibur 64, dsdd. \$10, other formats available. Catalogue \$8.00 P+P \$1. R.B. Archer & Assoc. PO Box 696, Ringwood, Vic. 3134.

**DESIGN ELECTRONICS:** Design, repair & service computer equipment — business & personal computer systems. Specialise in Tandy/Radio Shack Systems & All Disk Drives Very Reasonable Rates. BH: (02) 521 3341 AH: (02) 520 4583.

**BACK DATES:** Electronics Australia mags. 1966. "Radio Television and Hobbies" to 1949. Old Valves etc. Offers. Sydney (02) 48 4264

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MANUFACTURER OF QUALITY PRINTED  
CIRCUIT BOARDS — MODERN EQUIPMENT  
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Convert Mono TV to Stereo reception with our **ST182 Decoder** and your HiFi-system. Genuine Quasi-Split IF with Decoder. Output via DIN or Headphone socket. Write or phone for brochure.

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Cherrybrook, NSW 2120.

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**DISPLAY ADVERTS IN MARKETPLACE** are available in sizes from a minimum of 2cm x 1 col rated at \$15 for a col cm.

**CLASSIFIED RATES** \$3.60 for 40 letters or part thereof per insertion payable in advance. Minimum 80 letters.

**CLOSING DATE** is six weeks prior to the on-sale date. Issues are on sale the first Wednesday of each month.

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## WANTED

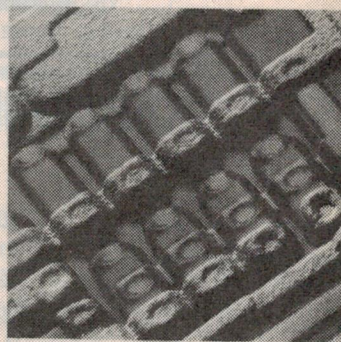
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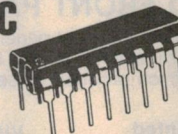
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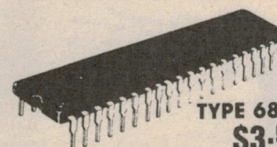
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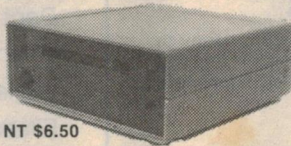
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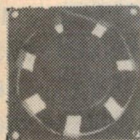
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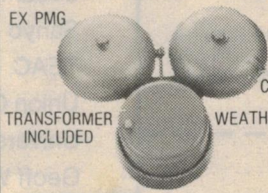
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Telephone 570 7000.

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Hurstville 2220.  
Telephone 570 7000.

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**RCS Radio Pty Ltd,**  
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Telephone 587 3491.

### Acetronics Printed Circuit Boards,

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Bass Hill, 2197.  
Telephone 645 1241

### WA

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**Jemal Products,**  
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### N.Z.

**Marday Services,**  
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**Mini Tech Manufacturing  
Co Ltd,**  
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**Printed Circuits Limited,**  
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### VIC.

**Rod Irving Electronics,**  
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Telephone 743 1011.

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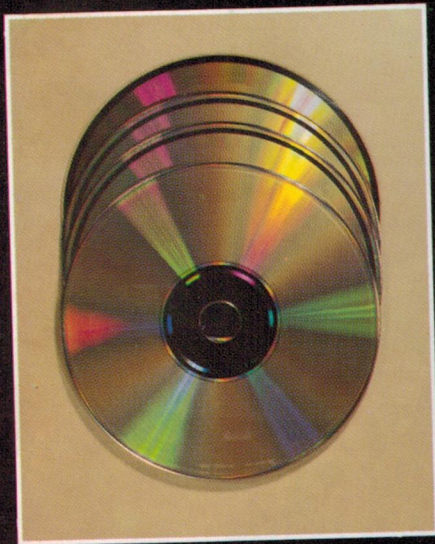
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- 3 direct-drive DC motors
- Direct-coupled playback EQ amplifier
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- 3 direct-drive DC motors
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